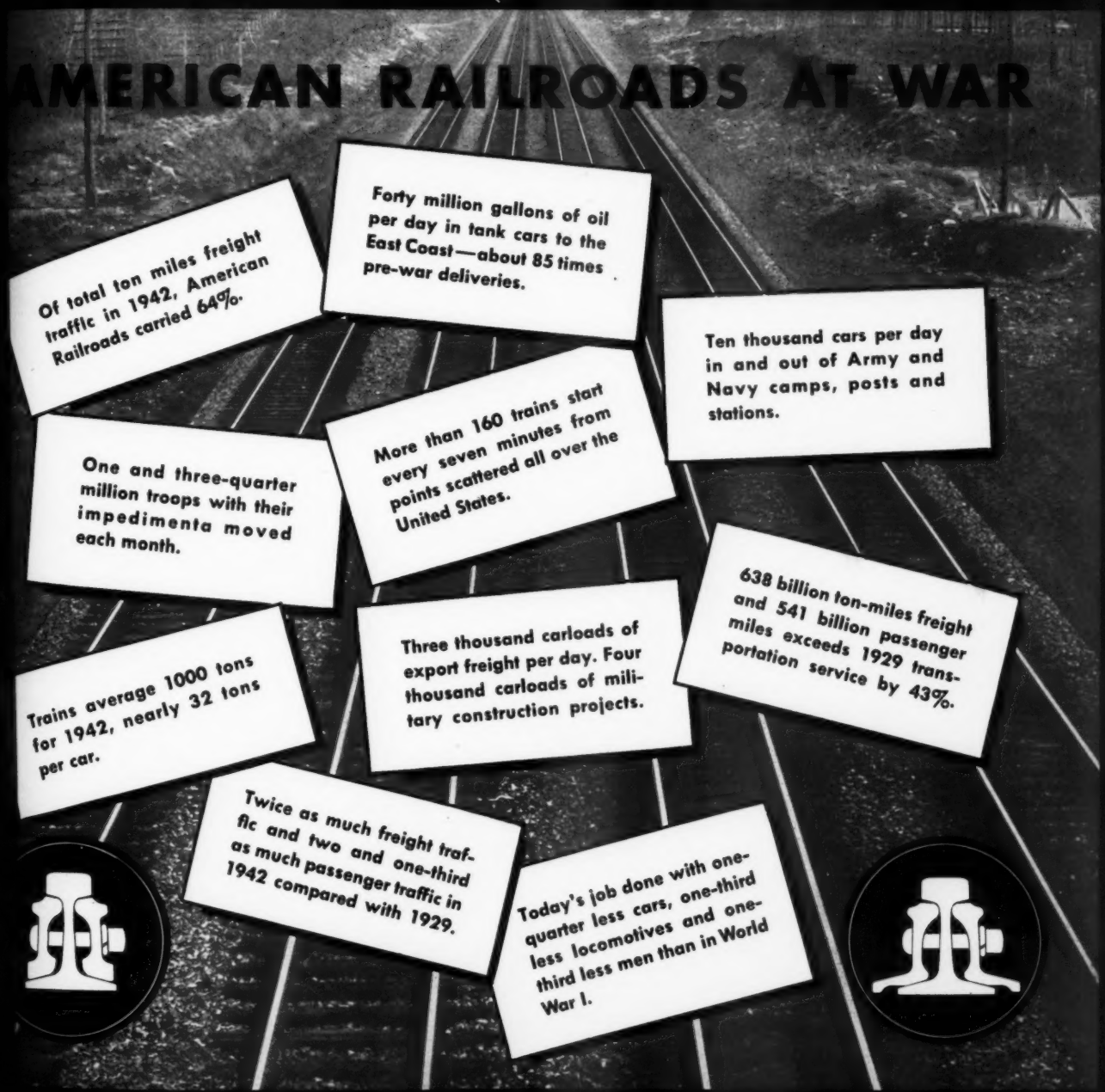
Railway Engineering and Maintenance


AMERICAN RAILROADS AT WAR
Of total ton miles freight traffic in 1942, American Railroads carried 64%.
Forty million gallons of oil per day in tank cars to the East Coast—about 85 times pre-war deliveries.
Ten thousand cars per day in and out of Army and Navy camps, posts and stations.
More than 160 trains start every seven minutes from points scattered all over the United States.
One and three-quarter million troops with their impedimenta moved each month.
638 billion ton-miles freight and 541 billion passenger miles exceeds 1929 transportation service by 43%.
Three thousand carloads of export freight per day. Four thousand carloads of military construction projects.
Trains average 1000 tons for 1942, nearly 32 tons per car.
Twice as much freight traffic and two and one-third as much passenger traffic in 1942 compared with 1929.
Today's job done with one-quarter less cars, one-third less locomotives and one-third less men than in World War I.

THE RAIL JOINT COMPANY INC.

50 CHURCH STREET NEW YORK, N. Y.

Reliance **HY-CROME** *Spring Washers*

"Edgemark of Quality"

HY-CROME SPRING WASHERS —A SPECIFIC KIND AND TYPE FOR ALL BOLT APPLICATIONS

Proper bolt tension—Service wear—Adequate reactive range—Sufficient reactive pressure—Proper release heights—Non-fatiguing pressure—All are important features connected with the problem of TIGHT BOLTS and subjects which have been given serious and constant consideration by our field, production and research engineers.

In Our HY-CROME Spring Washer family can be found the solution to your loose bolt or assembly problem.

Write for folder on HY-CROME Spring Washers or our service engineers will be glad to call and supply complete data.

Eaton Manufacturing Company

RELIANCE SPRING WASHER DIVISION

MASSILLON, OHIO

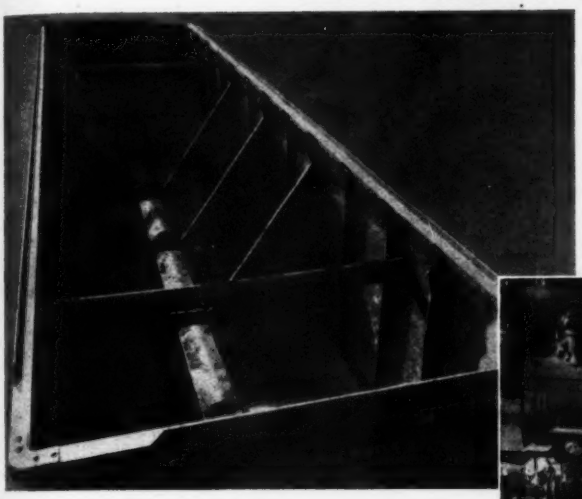
New York • Cleveland • Detroit • Chicago • St. Louis • San Francisco • Montreal

Published monthly by Simmons-Boardman Publishing Corporation, 105 W. Adams St., Chicago, Ill. Subscription price: United States and Possessions, and Canada, $2.00; Foreign, $3.00. Single copies 35 cents. Entered as second-class matter January 20, 1933, at the postoffice at Chicago, Ill., under the act of March 3, 1879, with additional entry at Mount Morris, Ill., postoffice. Address communications to 105 W. Adams St., Chicago, Ill.

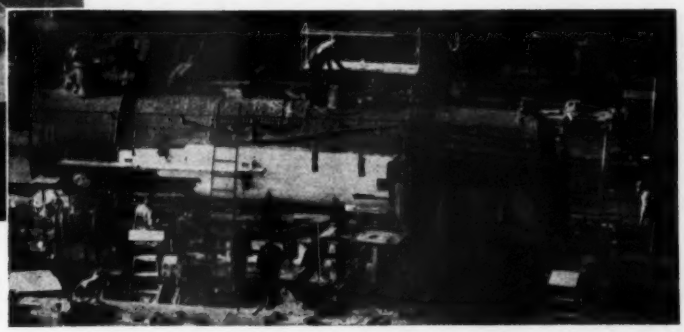
"HOLD-UPS"

STILL OCCUR ON THE RAILROADS

. . . but in a different way



Rust is the present-day robber. Vital equipment and motive power shopped for repairs and replacement of rusted-out members cause loss of time in service. And that's serious at any time . . . but much more so in wartime. Untimely repairs due to rust can be prevented by using NO-OX-ID . . . in fact more and more railroads have regular rust prevention programs which result in substantial savings of shop time and labor which can be diverted to urgent work.



Time to check up and stop RUST LOSSES

NO-OX-ID can be applied to existing equipment to prevent progressive rust, or it may be included in the specifications for new equipment or equipment going through your shop. NO-OX-ID acts mechanically to exclude moisture, oxygen, and other corrosion accelerators from metal surfaces, and chemically to inhibit corrosion under the film. Some of the places where NO-OX-ID can be used to advantage are suggested below.

TENDERS

- √ Entire inside surface of water tank, including splash boards.
- √ Tender coal space.
- √ Inside surface of stoker pit.
- √ Stokers, troughs, and parts, inside and out.
- √ Outside bottom surface of tank (also boards upon which tank rests).
- √ Top of tender underframe.
- √ Inside of center sills and top and bottom of top cover plates of old style tenders.
- √ Inside surface of new sheets applied to water tanks.

FREIGHT CARS

- √ Riveted joints and laps of underframes.
- √ Riveted joints and laps of sides and ends.
- √ Inside of body bolster construction.
- √ Inside of center sills and top of bottom and top cover plate.
- √ Inside of side stakes, corner posts and braces, and side sheet splice plates.
- √ On steel box cars over entire inside surface of sheathing behind wood lining.
- √ All other inaccessible parts.

LOCOMOTIVES

- √ Outside surface of boiler before lagging is put in place.
- √ All bright parts, such as side rods, piston rods, and inside of cylinders for protection in transit of new locomotives and those going through the shop.
- √ Cylinder bushings after boring.

"THE LEADER FOR 25 YEARS"

NO-OX-ID

IRON-OX-RUST

rust preventive

DEARBORN CHEMICAL COMPANY

Dept. U, 310 S. Michigan Ave., Chicago

New York • Los Angeles • Toronto

Write for NO-OX-ID Specification for Railway Equipment

Elastic

RAIL SPIKES

★ Retard Abrasion by Tieplates and thus

Conserve Ties

★ Reduce Hold-down spike and Rail-anchor requirements and thus

Conserve Steel

★ Provide better Maintenance of Line, Gauge and Surface and thus

Conserve Labor

ELASTIC RAIL SPIKE CORPORATION

Affiliate of Bernuth, Lembcke Co., Inc.

420 LEXINGTON AVENUE NEW YORK, N. Y.

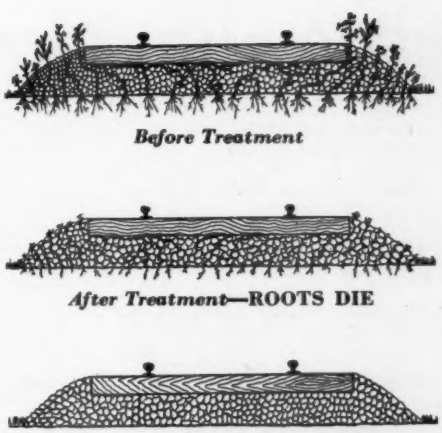
Houston » Pittsburgh » London

Do You Realize the War Time Advantages of Chemical WEED CONTROL?

Most important today—chemical weed control saves time and labor. Application is simple and rapid, requiring comparatively little man power.

Other control methods are temporary. But chemical control with ATLACIDE penetrates and *kills weed roots!* This assures reduction in the amount of weed regrowth with each treatment.

As weed growth disappears, track conditions improve, less chemical is required and maintenance costs are reduced. Thus, the goal of clean track at minimum cost is soon reached.



Before Treatment

After Treatment—ROOTS DIE

Final Result—CLEAN BALLAST

ATLACIDE NON-POISONOUS WEED KILLER • in Liquid or Spray Powder form

CHIPMAN CHEMICAL COMPANY, Inc.

BOUND BROOK, NEW JERSEY

Chicago, Ill. • Palo Alto, Calif. • Houston, Tex. • No. Kansas City, Mo. • Winnipeg, Can.

Over Twenty-five Years of Weed Control Service

PROLONG LIFE OF PRESENT AND FUTURE CURVE RAILS

Each Meco Lubricator Protects a Number of Curves

★ ★ ★ ★

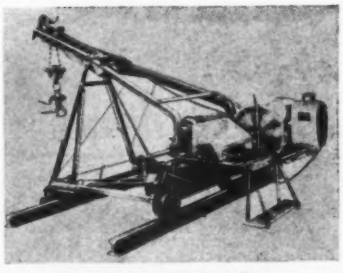
RAILROADS are planning for Post-War in many ways besides reducing capital investment—including the installation of equipment that will not only conserve materials *now*, but reduce costs for many years. MECO Lubricators fit into this program. They double to quadruple the *remaining life* of curve rails now in track—then stay on the job and keep on prolonging the lives of many generations of new curve rails.

MECO CURVE RAIL LUBRICATORS

1. Minimize curve rail wear otherwise caused by wheel flange friction.
2. Make curve rails last as long as tangent rails.
3. Reduce derailment hazards by decreasing curve friction.
4. Eliminate or reduce regauging and realigning of curves.
5. Greatly reduce respiking of ties on curves, and continual replacement of spike-killed ties.
6. Prevent possibility of train delays due to curve regauging or rail replacement work.
7. Make higher train speeds possible, with safety.
8. Speed up slow trains, thus decreasing "flow" of low rail.
9. Reduce wheel flange wear, particularly noticeable on locomotive wheels.
10. Permit increased tonnage ratings through divisions where curvature governs such ratings.
11. Reduce fuel consumption.
12. Frequently do away with helper service.

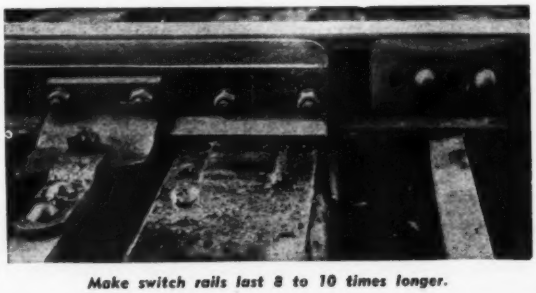
Let us Analyze Your Curve Territory Charts and Suggest Economical Lubrication

POWER RAIL LAYER



Requires no train orders.

MACK SWITCH POINT PROTECTORS



Make switch rails last 8 to 10 times longer.

MAINTENANCE EQUIPMENT COMPANY

RAILWAY EXCHANGE BUILDING • CHICAGO, ILLINOIS

CONSERVING MAN POWER

S2 Series E . . . A versatile 2 to 8 man Standard Section Car.

Fairmont
RAILWAY MOTOR CARS

Performance ON THE JOB COUNTS

Efficient handling with the least demand upon manpower is a main consideration in the design and construction of every Fairmont car . . . not only in numbers, but in time, energy, safety and health. In a word, Fairmont cars are built to do the biggest jobs with the least effort and the least manpower.

This feature is strikingly emphasized in the S2 Series E. In performance, this is a TRULY BIG Standard Section Car; heavy duty equipment for all the eight-man jobs, but so refined by skilled engineering that the energy of two men is sufficient for its hazard-free handling . . . even to removal from the tracks.

Nor has stamina been sacrificed for lightness of weight to "black-out" excessive manpower. Its gross weight is scientifically distributed for perfect balance. Add to this the use of light-weight alloys, structural steel punched aircraft style, and other refinements . . . all factors contributing to the reduction of the rear lift to a low of 145 lbs. Fairmont Railway Motors, Inc., Fairmont, Minn.

OF ALL THE CARS IN SERVICE TODAY ★ MORE THAN HALF ARE FAIRMONTS

POZZOLITH INSURES GREATER CONCRETE DURABILITY.

CEMENT DISPERSION

Santa Fe Railroad Bridge over San Mateo Creek, San Onofre, Cal. Piers extending 22 feet below streambed built with Pozzolith Concrete.

★ LOWER MAINTENANCE COSTS...

Reduced water content with easy placeability — the Pozzolith way to greater concrete durability . . . lower maintenance costs, in all types of railroad construction.

Resisting corrosion from salt water and chemical laden streams . . . erosion . . . disintegration from freezing and thawing, Pozzolith has been used with outstanding success in bridges, retaining walls, tunnels and dams.

Write and we shall be glad to have our nearest field engineer call or send complete information.

THE MASTER BUILDERS COMPANY
CLEVELAND, OHIO • TORONTO, ONTARIO

OTHER MASTER BUILDERS PRODUCTS USED EXTENSIVELY BY RAILROADS

EMBECO — non-shrink grouting and concrete repair material.
MASTERPLATE — non-colored and colored armoured surface floors.
OMICRON MORTARPROOFING — shrinkage control for masonry mortars.
MASTERKURE — membrane curing agent for all concrete.

HOW POZZOLITH
The Cement Dispersing Agent
IMPROVES CONCRETE

"Flocculated" Dispersed

Remember in physics how a group of suspended pith-balls would fly apart when given an electrostatic charge?

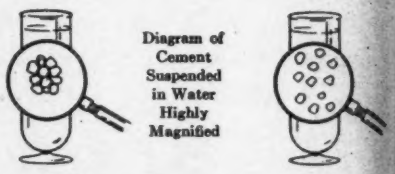


Diagram of Cement Suspended in Water Highly Magnified

Flocculated Dispersed

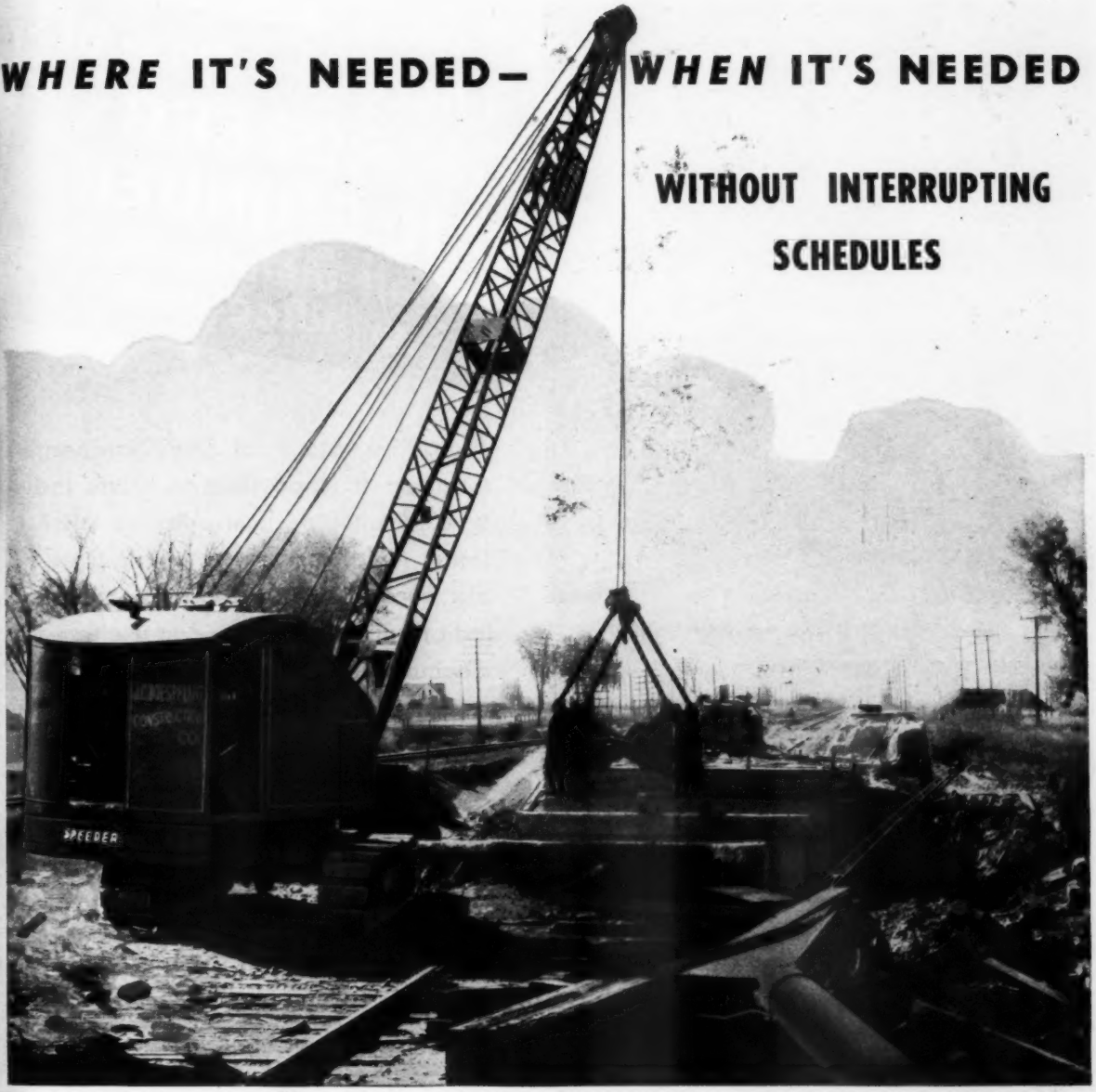
Similarly, cement particles which bunch together in water, or flocculate, are separated by this same electric force when Pozzolith is added to the mix. Thus greater cement surface area is made available to hydration, resulting in . . .

1. Putting more of the cement to work, by increasing the amount of hydration as much as 40%.
2. Increasing workability, producing up to 2½ times as much slump with the same amount of water.
3. Permitting up to 20% reduction in water, maintaining placeability . . . increasing strength . . . watertightness . . . and durability.

MASTER BUILDERS

WHERE IT'S NEEDED— *WHEN* IT'S NEEDED

WITHOUT INTERRUPTING SCHEDULES



Off-Track Equipment

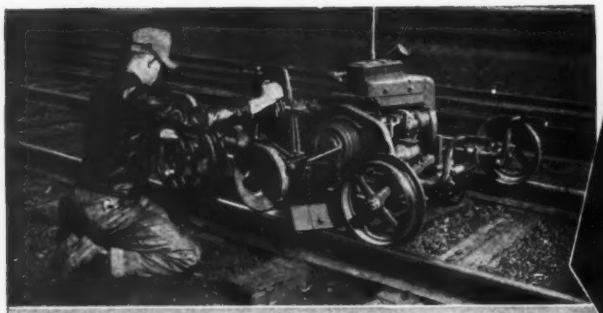
Link-Belt Speeder shovels, draglines and cranes are assisting the Roads in maintaining right-of-way, banking, ditching—are doing this vital work without interfering with other equipment or necessitating upsets in schedules. A Link-Belt Speeder travels under its own power—goes about its business without interfering with routine operations.

S109

LINK-BELT SPEEDER

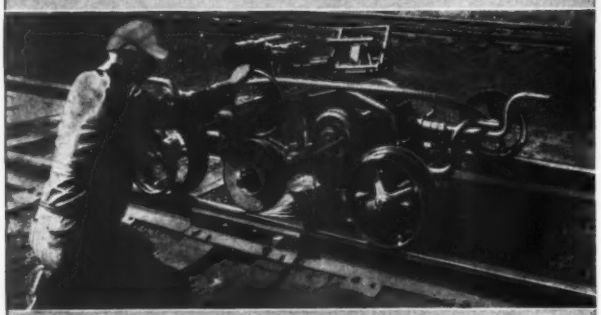
BUILDERS OF THE MOST COMPLETE LINE OF
SHOVELS—
CRANES—
DRAGLINES

LINK-BELT SPEEDER CORPORATION, 301 W. PERSHING ROAD, CHICAGO, ILL.
(A DIVISION OF LINK-BELT COMPANY)

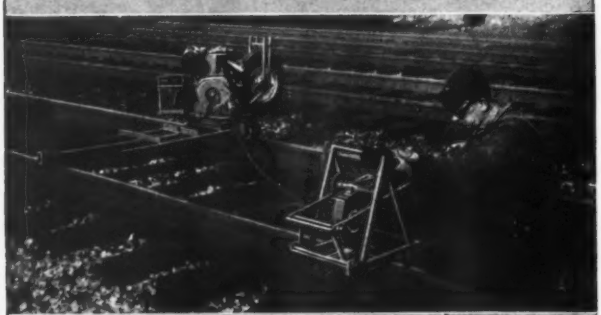


Model BG Heavy Duty Surface Grinder

There is a type of NORDBERG RAIL GRINDER for all maintenance grinding work

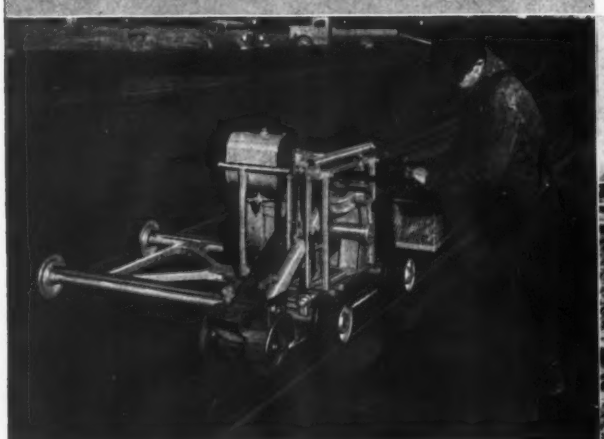


Model DG Light Weight Surface Grinder



Model UG General Purpose Utility Grinder

From this group of five Nordberg Grinders it is possible to select the type of machine best adapted to all forms of maintenance grinding. Every rail reconditioning program involving grinding operations can use these machines to advantage, not only because of their precision but for speed and capacity of work. This is especially important in these days of labor shortage. If you are doing grinding on rail, switches, crossings, etc., investigate the merits of Nordberg Grinders on maintenance work.



Model FG Flexible Arm Grinder

Model FG Midget Grinder

NORDBERG MFG. CO. MILWAUKEE WISCONSIN

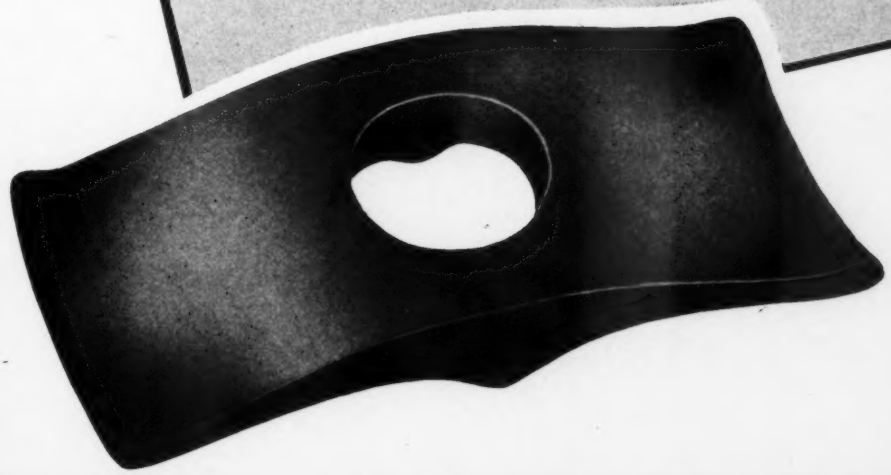
Export Representative—WONHAM Inc.—44 Whitehall St., New York

GUARDING
VITAL TRANSPORTATION LINES

VERONA FIXED TENSION TRIFLEX SPRINGS
Eliminate Buckling and Pulling Apart of Track

Verona Fixed Tension Triflex Springs are calibrated to provide equal and proper bolt tension permanently, insuring better functioning of rail anchors and eliminating buckling and pulling apart of track when temperature changes are as severe as they have been this year.

No spring washer for track bolts should go flat before reaching a practicable and working bolt tension. The Verona Fixed Tension Triflex Spring provides not only enough free travel to reach adequate bolt tension, but also a means of arriving at equal bolt tension in all bolts. Plus, of course, reactive spring pressure more than 250% of A.R.E.A. requirements, to maintain this tension after joint wear.



SINCE 1873

WOODINGS-VERONA TOOL WORKS, VERONA, PA.

SINCE 1873

Even CP Compressors
MUST BE LUBRICATED

CP Portable Compressors are equipped with a force feed system of lubrication which is automatic, positive, economical — and which also keeps the air relatively oil-free. Nevertheless, for the dependable, uninterrupted service so essential under war conditions, there are a few manual operations which should be performed regularly. Four of these are illustrated below; others will be presented in future advertisements.

HOW TO GET MAXIMUM SERVICE FROM YOUR CP PORTABLE COMPRESSORS

1 Remove air intake filter, clean with kerosene weekly. Dry all parts before replacing. Fill oil to bead indicated on outer casing.

2 Lubricate the fan bearings with a grease gun every three hundred operating hours. Use a semi-fluid grease of good grade.

3 Keep crank case filled to indicated level. Drain every 100 operating hours. Refill with grade of oil specified in instruction book.

4 Get the habit of checking compressor and engine oil pressure gauges frequently on each shift. Pressure should be about 25 lbs.

★★★★★★★★
PNEUMATIC TOOLS
ELECTRIC TOOLS
(Hicycle...Universal)
ROCK DRILLS

CHICAGO PNEUMATIC
TOOL CP COMPANY
General Offices: 8 East 44th Street, New York, N. Y.

★★★★★★★★
AIR COMPRESSORS
VACUUM PUMPS
DIESEL ENGINES
AVIATION ACCESSORIES

WHY RAILROAD MAINTENANCE IS VITAL TO VICTORY

AND MAINTENANCE EFFICIENCY INCREASES WITH . . . . . FLEX-TOE CLAW BARS

NOT only are the quantities of material available for railroad maintenance and repair limited, but the amount of man power is also contracting. Since the railroads must move unprecedented quantities of war materials, plus necessary supplies for civilian existence, and since THEY ARE DOING this big, double job with fewer cars, less locomotives, and fewer men, labor-saving maintenance tools like Flex-Toe Bars and long-life Devil Tools become of increased importance. • Consider Flex-Toe Bars now. Two men using Flex-Toe will pull as many spikes as three men can with ordinary bars. All headless spikes and bolts come out more quickly than ever before. There's no shimming under the heel with Flex-Toe Bars, and spikes come out of hard-to-get rail joints, etc., in half the time. There's no spike maul driving...nothing new to learn. IT'S A ONE MAN BAR. Hence, spike pulling becomes faster, safer, and less costly. Write today for literature on Flex-Toe Bars and Devil Hand Tools.

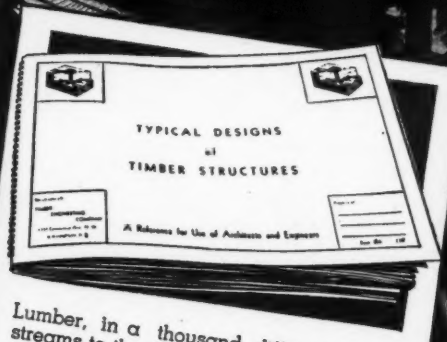
WARREN HEAVY HAND TOOLS

WARREN TOOL CORP. • WARREN, OHIO

FREEDOM IS NOT FREE—IT IS PRICELESS — BUY WAR BONDS

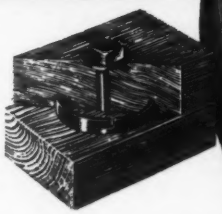
SELECTED FOR SERVICE

Topping the "spar tree" preparatory to forestry operations. Selective harvesting of fully matured trees in the surrounding forest will assure continued forest growth.



Lumber, in a thousand different forms, streams to the fighting fronts of the world. At home, wood replaces metal in thousands of heavy duty war structures—made possible by the TECO Connector System of Timber Engineering. This FREE Reference Book shows details of 45 typical timber designs for roof trusses, bridges, towers, tanks, hangars, and other structures for the war today and the peace tomorrow. Available to practicing engineers and architects. *Write for it today*—using your firm letterhead.

The *TECO* Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.



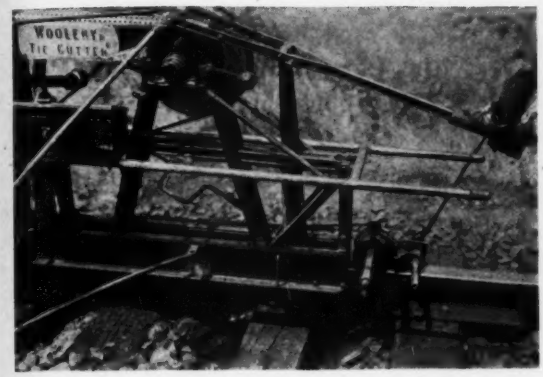
TIMBER ENGINEERING COMPANY

NATIONAL MANUFACTURERS OF ***TECO*** *TIMBER CONNECTORS AND TOOLS*

WASHINGTON, D. C. **PORTLAND, OREGON**

WOOD GOES TO WAR — An MGM Technicolor short by James A. Fitzpatrick. Ask your theater when you can see it.

When Time Is SHORT-SAVE IT!



With the Woolery Tie Cutter trenching is eliminated. There is minimum disturbance to ballast, and surfacing is reduced one-half.

WOOLERY TIE CUTTERS Do Double Duty

Increase Tie Output 30 per cent Release Labor for Other Tasks

Today, as never before, maintenance men must get the maximum of track work done in the shortest possible time. It's not just a question of lowering costs—though that is still important and, incidentally, a feature of the Woolery Tie Cutter—but of doubling the efficiency of the totally inadequate supply of labor that is available.

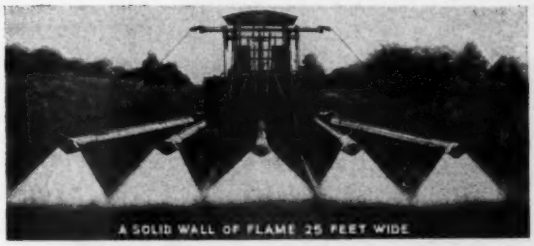
With comparatively little instruction, an inexperienced man can operate the Woolery Tie Cutter in stone, gravel or other ballast. The tie is simply cut into three pieces, which are easily lifted out, leaving a practically undisturbed bed for the new tie.

The Woolery Tie Cutter increases tie renewal output as much as 30%. It releases labor for other urgent tasks that much sooner. It is easily carried to the point of use on the side of a motor car. Designed for perfect balance, the Cutter can be lifted on and off the track by its operator in 10 seconds.

Write Today for Full Particulars on Woolery Time- and Labor-Saving Equipment!

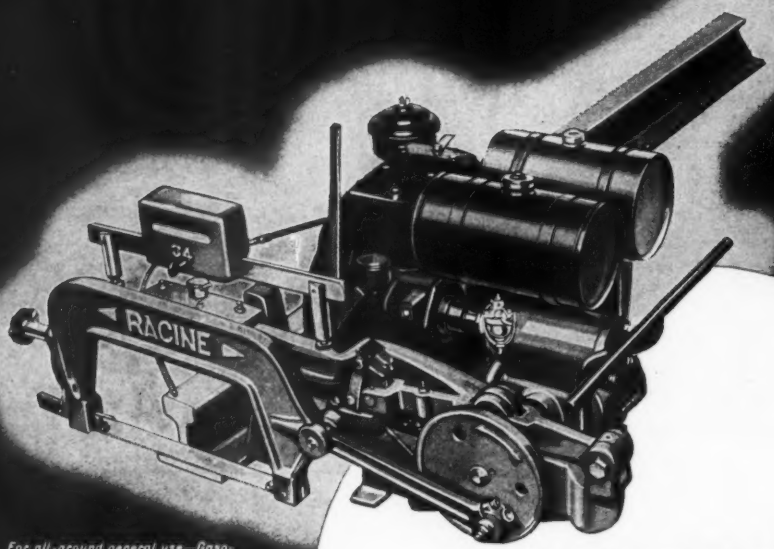
WOOLERY WEED BURNERS TOO Save Time and Labor

Woolery Weed Burners are proving their time- and labor-saving qualities on more than sixty railroads. With Woolery Weed Burners, two men can destroy weeds quickly and thoroughly. There are models available for every track need: Octopus 5-burner and 3-burner models for main line track, and the Midget 2-burner and Junior 1-burner models for branch lines and yard.



Above: 5-burner Giant Octopus Model. 3-burner, 2-burner and 1-burner Models are also available.

WOOLERY MACHINE COMPANY
Minneapolis, Minnesota



For all-around general use—Gasoline Engine operated—blower-cooled type, four cycle, one horsepower capacity.

For use where compressed air is available—Compressed Air Motor operated—Rotary or vane type developing over 1 H. P. Highly desirable for use where combustionable gases are apt to exist.

For use on electric railroads—Electric Motor operated—with proper electrical characteristics for use on available power lines.

RACINE

High speed-portable

RAIL CUTTING MACHINES

The "One Man" Rail Cropping Saw

For SIMPLE—FAST—SAFE *Cutting "On the Track"*—Now more than ever before, higher speeds, heavier and more frequent trains, carrying important war materiel, depend on sturdy flawless trackage. Racine Portable Rail Cropping Machines are designed and built to do the job of rail maintenance right "on the track"—no extra handling of equipment or rails—no need for using cars in non-revenue producing service. No delays incident to train movements while cutting and relaying rails.

The use of Racine Rail Cutters does away with over-heat or burn of grain structure—thus reducing split ends. It does not shatter rail ends as in the nick-and-break method.

RACINE RAIL CUTTERS—DO IT FASTER AND CHEAPER—Only one man required to operate—Results in big saving in power, tool and time costs. Any two men can easily transport cutter.

A Racine Rail Cutter will cut a standard 80-pound rail in five minutes—100-pound rail in seven minutes and a 130-pound rail in nine minutes.

Smooth and accurate facing of rail is assured when a Racine Rail Cutter is used. Any amount down to three-tenths of an inch can be cut from rail. Capacity for regular rails—7⅛" x 6½". Capacity for special or Trilby rails—9" high x 6½"

OTHER RACINE METAL CUTTING MACHINES—*The Production Saws of Modern Industry*—Hydraulically fed and operated metal cutting machines for general purpose and production work in railroad repair and maintenance shops. Capacities 6" x 6" to 20" x 20".

RACINE HYDRAULIC PUMPS AND VALVES—Oil Hydraulic "Variable Volume" Pumps for pressures up to 1000 lbs. per sq. in. at capacities 0-12, 20 or 30 gal. per min. Hydraulic Valves—⅜" to 1½" standard pipe sizes—with mechanical, electrical and manual operating devices.

Complete information and prices gladly furnished on request. Address your inquiry to Dept. RE-S.

STANDARD FOR QUALITY AND PRECISION
RACINE
RACINE TOOL and MACHINE CO.

RACINE TOOL AND MACHINE COMPANY

STANDARD FOR QUALITY AND PRECISION

RACINE, WISCONSIN • U. S. A.

IDEAL FOR 1943's VITAL TRACK MAINTENANCE PROGRAM

Make full use of

DEPENDABLE, EFFICIENT DUFF•NORTON JACKS

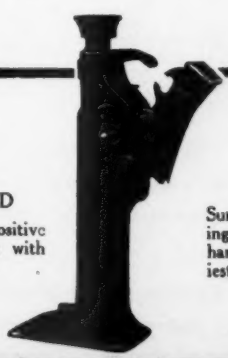
No. 117
The railroad man's favorite everywhere.

1943's expanded track maintenance and service program will mean harder, more gruelling work for all of your men and equipment. It means you've got to make the most of every man, machine and tool you have.

Your dependable, efficient Duff-Norton Jacks will help you in this speed-up of your track work. These sturdy "mechanical muscles" are built to stand up under the toughest kind of day-in and day-out service. Make the most of them in '43!

Catalog 201 fully describes the entire Duff-Norton line — gives you helpful data on these Jacks — the railroad man's favorite. Have you a copy in your files?

No. 304
This Side-Lift Jack is a handy tool.



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A quick, positive Trip Jack with hook trip.

No. 517
Surface and Lining Jack. Easily handles the heaviest rails.

"THE HOUSE THAT JACKS BUILT"

THE DUFF-NORTON MANUFACTURING CO.
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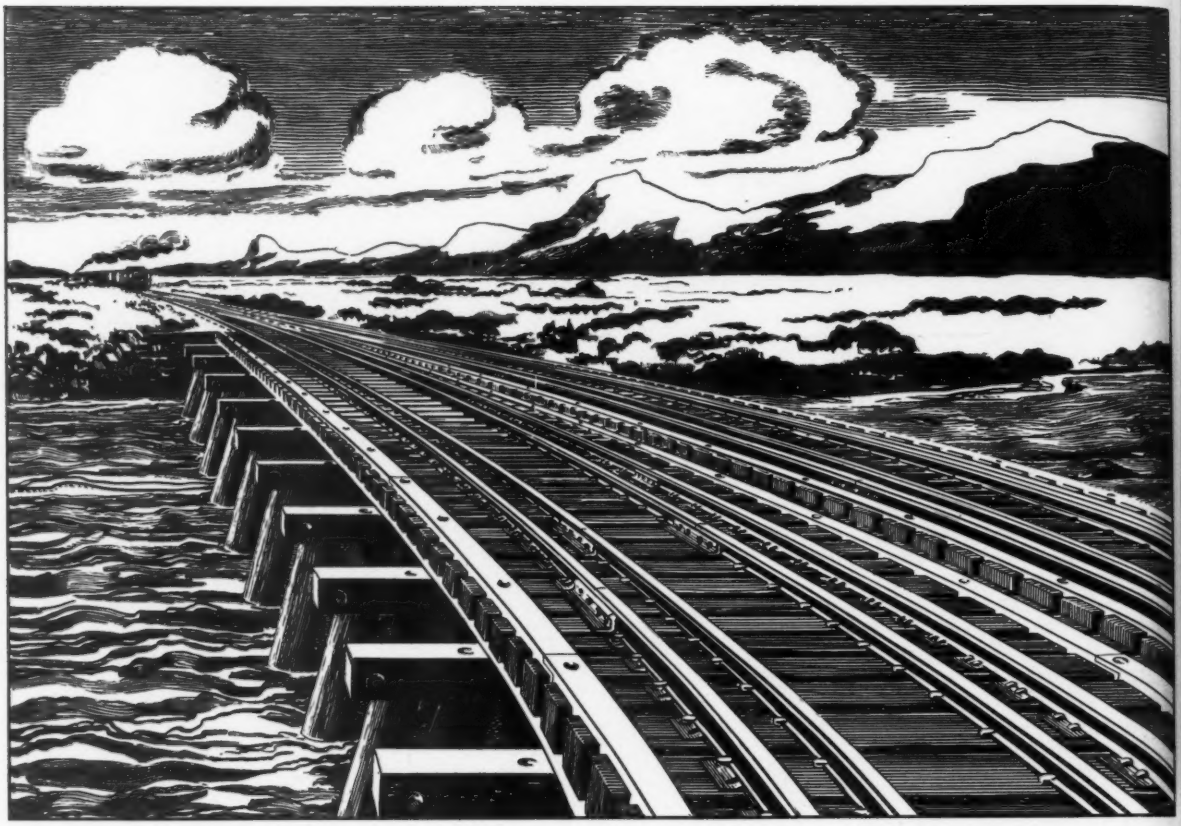

HOT COALS AND SPARKS WILL NOT "SABOTAGE" THIS TRESTLE

THIS IS WAR . . . and no time to gamble with bridge fires. That's why railway engineering and maintenance men are turning more and more to "CZC"-treated wood.

"CZC"-treated wood is used for ties and stringers because it has high, measurable fire resistant qualities. Neither hot coals nor sparks will ignite it.

What a beating all bridge construction takes these days! That's another reason railway men choose "CZC"-treated timber . . . it resists decay . . . makes ties last *many* times longer!

Important, too, is this fact: In many cases treatment with "CZC" will permit the use of less expensive, more readily available grades of timber . . . compensating in whole, or part, for the treating cost.

Remember "CZC" when you're considering ties, bridges (ties, stringers and fire stops), tunnel linings, roundhouse roofing, loading platforms, warehouse flooring, pier decking . . . all construction subjected to severe service conditions.

There is ample preservative and treating capacity to meet both military and essential transportation requirements. "CZC"-treated lumber will give you a better job . . . resist fire . . . retard decay . . . require less maintenance. E. I. du Pont de Nemours & Co. (Inc.), Grasselli Chemicals Department, Wilmington, Del.

DU PONT

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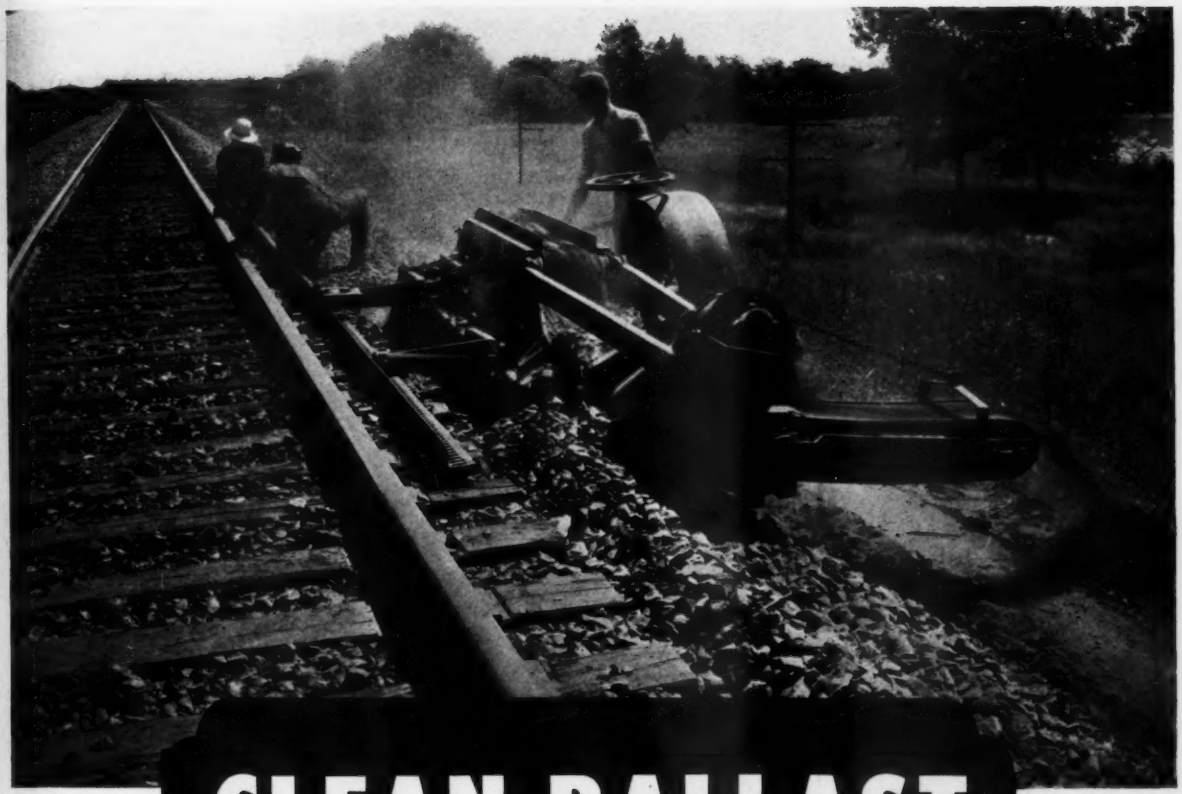
CZC

CHROMATED ZINC CHLORIDE

WOOD PRESERVATIVE

BETTER THINGS for BETTER LIVING . . . THROUGH CHEMISTRY



CLEAN BALLAST

is Essential for Wartime Transportation

At a time when the track is carrying record traffic, adequate drainage and adequate track support, provided through properly maintained ballast, are primary requisites.

MOLES Clean Ballast Without Disturbing Traffic

Wartime speeds and the increased number of trains make doubly important the use of the MOLE Ballast Cleaner for it does a thorough ballast cleaning job **without occupying the track or interfering with the free movement of traffic.**

MOLES Also Save Labor

Either Border or Intertrack units can be operated efficiently by **only** three men. Furthermore, the MOLE can be loaded on a push car and moved around an obstruction or to a new location by these three men with the Demountable Mole Derrick, **eliminating all work train expense and gang delay waiting for a lift.**

RAILWAY MAINTENANCE CORPORATION

PITTSBURGH **PENNSYLVANIA**

No. 173 of a Series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: It's Great to be a Maintenance Man

May 1, 1943

Dear Reader:

"The most amazing thing about the Arkansas division's stellar performance in the purchase of war bonds was the work of the maintenance of way forces. As everyone knows, they are not the highest paid workers on the railroad; in fact, they are far from it. Yet the division's maintenance forces are now investing the astounding total of 17.9 cents in war bonds from each dollar earned --a record matched by few, if any, comparable groups in the United States."

This was the tribute paid to the maintenance of way forces of the Arkansas division of the Missouri Pacific by H. E. Roll, chairman of that railway's war bond executive committee in commending that division for being the first major operating unit of that system to exceed its 10 per cent quota with a division ratio of 10.4 per cent. In contrast with the 17.9 cents of the maintenance of way men, agents, telegraphers, clerks and other office and station employees subscribed 12.6 per cent, while the enginemen, firemen, hostlers, conductors, trainmen and yardmen subscribed only 9.3 per cent.

This record deserves commendation and it is to the credit of the Missouri Pacific that it gave these employees such well-merited recognition. Yet I am certain that you will share my feeling that it is what we would expect from these men. It is characteristic of that loyalty to employer and to country that has long made the men of this branch of the service the basis with which other departments are compared. In their devotion to duty in the day-to-day routine of track and structures repair, as well as in the emergencies that arise at intervals when all personal interests must be subordinated to the restoration of service. It is a tradition of the rails that the maintenance forces will be found on the job until the last spike is driven. And in national emergencies the same inherent traits of loyal sacrifice are evident.

Records such as that made by the men cited above give every maintenance of way man, on every road, an added appreciation of the fact that "It's great to be a maintenance of way man".

Incidentally, I wonder if the maintenance forces on any of your divisions of comparable size have equalled or exceeded this ratio of war bond purchases.

Yours sincerely,

Elmer T. Howson

ETH:GP

Editor

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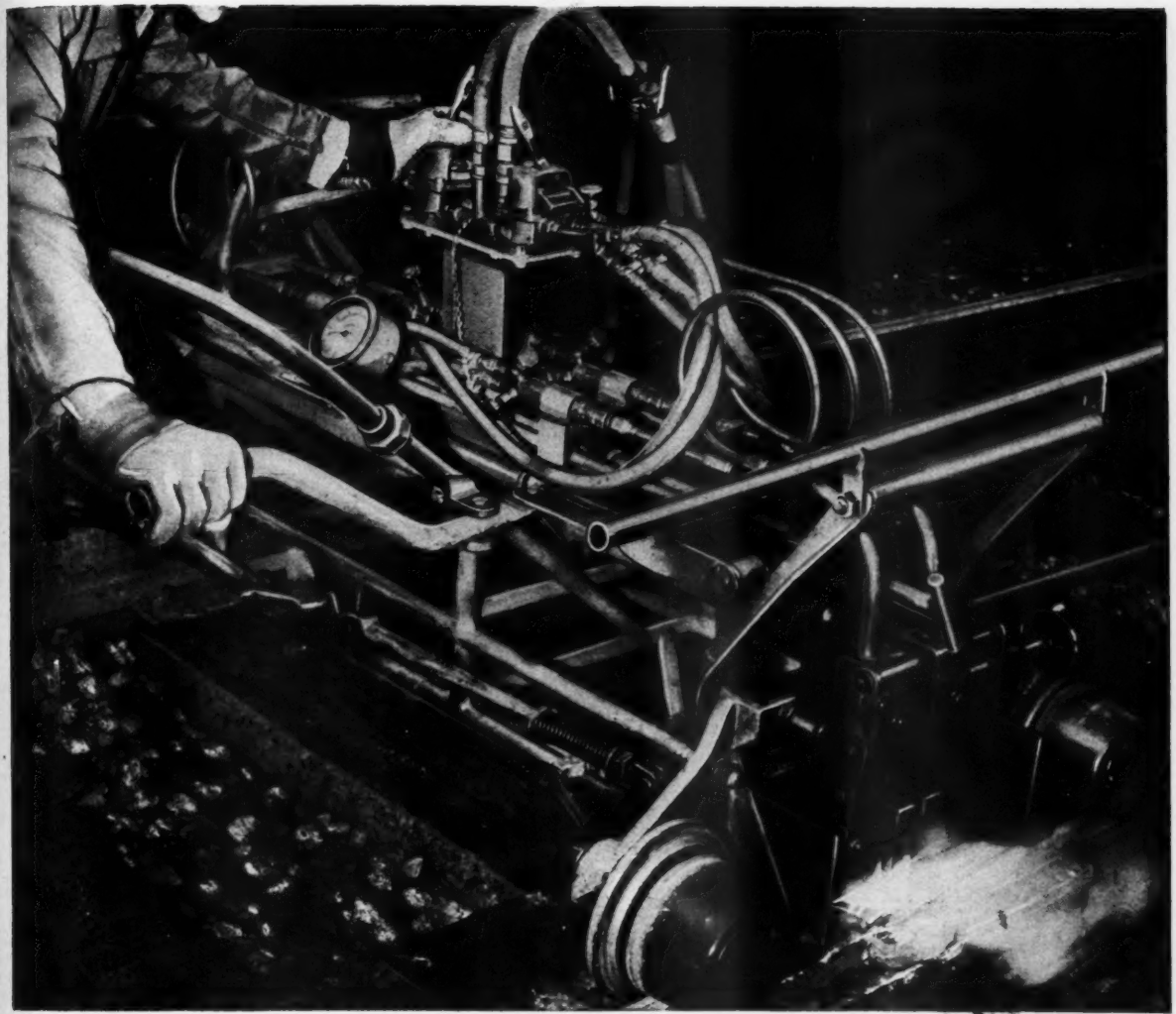

Oxy-Acetylene End-Hardening Conserves Critical Materials

● Rail-end hardening conserves rail by retarding batter. This flame treatment lengthens the life of rail in first position and materially reduces wear on joint bars and bolts — hence there are fewer replacements over the years and less need for the use of critical materials in building up battered and worn rail ends.

By specifying Oxweld end-hardening as a part of new rail-laying programs, railroads can save valuable materials and man hours.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation
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Carbide and Carbon Building Chicago and New York

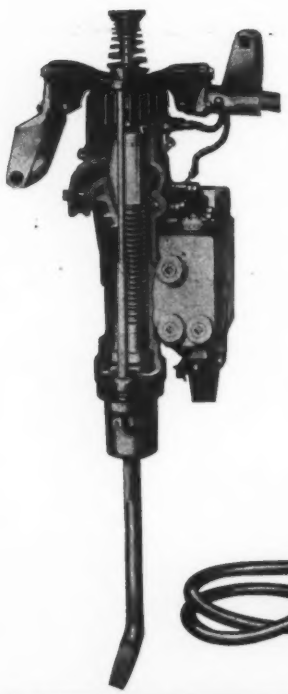
SINCE 1912—THE COMPLETE OXY-ACETYLENE SERVICE FOR AMERICAN RAILROADS

The word "Oxweld" is a registered trade-mark.

IN USE ON 90 RAILROADS

and

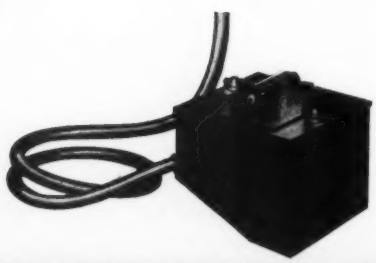
7 YEARS SATISFACTORY SERVICE



BARCO *Tytampers*

Improve Maintenance of Way!

1943 railroad traffic is expected to exceed by 10% the peak traffic of 1942, making it essential to prolong the rail life by spot tamping joints and otherwise keeping the ballast in suitable condition.



BARCO UNIT TYTAMPERS may be used with large gangs in relaying rail or out-of-face tamping and may be split up into small units of two or four for spot tamping by the various section gangs.

BARCO MANUFACTURING COMPANY

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MAY, 1943

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Editor

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Help Keep the Cylinders on the March

Return Empties Promptly

To keep you supplied with oxygen and acetylene gas for essential track maintenance, and at the same time meet the demands of other war industries, requires thousands of steel cylinders.

Vital war weapons now use most of the high grade steel from which cylinders are made; therefore new cylinders are only being produced in relatively small quantities.

Active duty for every oxygen and acetylene cylinder will help beat the cylinder shortage. You can help by seeing that every empty cylinder is returned promptly to a convenient pick-up point.

Working together, we can solve our common problem, and help the railroads continue their outstanding service in America's drive for victory.

Air Reduction

General Offices: 60 E. 42nd ST., NEW YORK, N. Y.

IN TEXAS

MAGNOLIA-AIRCO GAS PRODUCTS CO.

General Offices: HOUSTON, TEXAS

AIRCO

WILSON

IDLE CYLINDERS ARE PRODUCTION SLACKERS: *Keep 'em rolling for victory!*

Railway Engineering and Maintenance

Trucks—

Proponents Make Surprising Statements

In a frantic effort to prevent their vehicles from being barred from uneconomic competition with the railways, the highway truckers, through the American Trucking Associations, has published advertisements in the daily papers that are designed to confuse the public, and possibly many railway employees, about the limitations and shortcomings of trucks in the general transportation of freight. Indicative of the means adopted to make a case for the sorely-pressed trucks are statements in these advertisements that "with 1/20 the railroad capacity, trucks haul 1/4 the load in less than half the time". The object of this misleading attack on the railroads is set forth in a further statement (in smaller type) as the complete removal of state highway regulations on truck sizes, (speeds?), weights and lengths, etc.

The effrontery of these parasites on the highways in demanding that the states, after providing the roadways for their use at charges of a mere fraction of their cost for repairs, shall forego means of protecting that investment from destruction by these "freight cars on wheels" for the public at large—the public that pays the bill—is an illuminating evidence of the desperation of that industry.

It is not surprising that the railways challenged these statements promptly and aggressively. J. J. Pelley, president of the Association of American Railroads, directed attention promptly to the fact that the combined capacity of the 600,000 for hire and the 4,291,000 private trucks (as shown by Motor Truck Facts) have a combined capacity (as reflected by their average loads) of 13,373,670 tons, while the 1,853,681 freight cars in service have an aggregate capacity (based on their average load) of 51,000,000 tons. The ratio of truck to railroad capacity is, therefore, 1 to 4 instead of 1 to 20.

Characterizing as similarly misleading the truckers' statement about the relative service rendered by the two agencies, Mr. Pelley pointed out that the annual report of the Interstate Commerce Commission shows that the railroads created 376,218,000,000 ton miles of freight while public and private trucks created 31,121,000,000 ton miles. The ratio of truck to railroad ton miles is, therefore, less than 1 to 12, instead of 1 to 4. Furthermore, if the truck service is confined to that rendered by trucks for hire, the ratio is 1 to 14.

President Pelley points out also, and significantly, that the trucks received 3.986 cents a ton mile while the railways received 0.945 cents, affording an obvious measure of relative cost of service of 4 to 1.

Nowhere in the truckers' advertisement does one find reference to the difficulties that Germany is now reliably reported to be experiencing in its war transport through placing major dependence on a system of super highways and highway transport. Rather, these advertisements are an attempt to becloud the fact that, in its present emergency, our nation has turned to the railways as the only agency that is prepared and able to provide the service demanded, nationwide.

By reason of the prominence given the truckers' advertisements, it is important that the one and a quarter million railway employees know the true facts and that they disseminate them as widely as possible in order that the public may be able to see through these claims and exercise that control over the use of the public highways after the war is over that governmental agencies, concerned only with the most efficient conduct of transportation, are now exercising.

Paint Brushes—

Limited Supply Calls For Careful Use

BECAUSE they comprise one of the most common tools used by bridge and building forces, good paint brushes have often been taken for granted in the past by many of these men. As a result, it cannot be said that proper use and care have always been extended to such brushes, even though it has long been common knowledge among experienced painters that their proper care and use are essential to the highest quality work. Where carelessness in the use and care of brushes was practiced heretofore, it was with the subconscious knowledge that suitable replacements were always readily available.

Today, the situation as regards the availability of quality brushes has changed radically, and while replacements are still available, the quality of these replacements is greatly inferior to anything to which bridge and building men have been accustomed for many years in the past. Faced with such a situation and with large programs of essential painting that must be done on the railways currently to conserve the critical materials in their properties, it behooves every maintenance man who uses paint brushes to give the greatest care to those pre-war brushes on hand, both in their use and in their preservation after use.

Equipment Maintenance—

More Prudent Today Than Repair

FACING one of the most strenuous working seasons in their history and the further fact that the purchase of additional units of work equipment is more highly restricted than heretofore, the watchword of those who employ such equipment in the months ahead should be the "maintenance" of every unit to the highest degree of efficiency—maintenance against unnecessary wear—maintenance against the premature failure of parts—and maintenance against careless or faulty operation.

If this thesis is accepted, the equipment maintainer becomes a key man in the maintenance of way organization and should be called a "maintainer," rather than a "repairman." A repairman is one who repairs, and too often repairs require vital, scarce parts and materials, take machines out of service and cause delays to gangs and work programs. Under the most careful set-up of equipment operation and maintenance, there is a definite place for repairmen, because parts will wear out and failures will occur, but under today's conditions, the equipment maintainer—the man who visits the machines in the field before they fail, who instructs and cautions operators, and who anticipates trouble and forestalls it—can be the most valuable man in the work equipment set-up on any road.

The weakest link in the work equipment organization on many roads has been the maintenance of the equipment. Too often the attitude has prevailed that unless a man was tearing down a tool or machine he was not rendering a valuable service; that until a part actually failed in service, its maximum life was not being obtained. That concept must be abandoned, as must the concept that assigns so many machines to a maintainer that he cannot possibly visit them in the field until they fail; that allows him no time to train operators or to discuss their problems with them. Under present conditions, a single equipment maintainer to a district or division, or even assigned to a large work organization, may be entirely inadequate. Today's conditions, involving many inexperienced operators, the intensive use of equipment, and the employment of many machines that, under other conditions, would have been scrapped, may call for two or even more maintainers where one was employed before. And these maintainers should be given the means and the time to keep intimately in touch with every machine and machine operator in the field.

Those roads that adopt this newer concept will be well repaid, not only in greater machine and manpower output during the coming working months, but also in fewer demands for scarce repair parts during the winter months that follow when reconditioning of the equipment is again undertaken. On most roads it will be a case of maintainers or repairmen. The course of prudence points in the direction of the former.

Labor Problem—

Demands First and Most Serious Consideration

SIX months ago, materials were the No. 1 problem of the maintenance of way forces of the railways, and while that problem is no less serious today than it was at that time, and is growing even more critical with respect to specific items, it has now been forced into second place by the serious shortages existing in maintenance labor—shortages that are widespread over the country, in the face of abnormally heavy programs of essential work, and at a time when the maintenance forces should be expanding rapidly. Already, the labor problem has become so acute in many sections that the railways cannot install and service properly even the limited quantities of materials that have been made available to them. That this is true is evidenced by the fact that today, in some localities, new rail lies on the ground awaiting the accumulation of adequate forces to install it in the track. Still more serious is the fact that, with shortages in their track forces ranging from 10 to 50 per cent, many roads cannot hope to maintain adequately the facilities that they already have.

Bad as this situation is at present, there is every indication that it will not improve—that it will become still worse—and there is nothing to be gained by refusing to face this fact. On April 21, no less an authority than Brig. Gen. William C. Rose, chief of the executive services of the War Manpower Commission, warned that essential industries will lose as many men to the armed forces this year as they have lost already through induction by Selective Service, declaring that most of the more than 4,000,000 men who will be added to the armed forces in 1943 will have to be drawn from the present labor reservoir. "These men," he declared, "will have to come largely from essential industries which have been able in the past to obtain deferments for more of their trained and key personnel than will

be possible under new Selective Service regulations." This situation, especially in the light of the fact that section and extra gang labor has not been considered trained or key personnel by Selective Service in the past, and is not likely to be so considered in the future, in spite of the essentiality of its work to the war effort, forecasts a critical labor situation in the maintenance of way ranks of the railways unless modified by government action, and offset by Spartan efforts on the part of maintenance officers to recoup losses.

And the further drains of Selective Service are not the only concern of maintenance officers for their labor requirements, because they know full well that despite the War Manpower Commission's so-called labor "freeze" order of April 8, there is no restriction against employees in one essential activity leaving that activity to engage in another essential activity at the same rate of pay, and, likewise, nothing to prevent such employees from accepting employment in other essential activities, with increases in pay, if their transfer is authenticated by the WMC under any of the 60 stabilization programs which it has set up about the country. That the Commission, acting under orders to give first consideration to the labor needs of war plants and of agriculture, may permit further deflection from the ranks of the track forces, is another and serious possibility.

While urging at every opportunity the importance of not stripping the track forces further, every maintenance officer should give the fullest consideration to every means of building up his forces and of discouraging voluntary deflections for any cause. Some of the various expedients that are being employed by various roads to these ends, and with considerable success in many cases, include the more intensive solicitation of manpower by the road's own supervisory forces, and through their usual agencies and the Federal Employment service; the recruiting of labor in areas of least labor scarcity for work in areas of greatest shortage; the lengthening of the working day beyond eight hours, and permitting work on Sundays; increased rates of pay and improved housing and boarding facilities at reduced cost; more intensive programs of constructive work during off-seasons, to provide steady employment; the full-time employment of women in those positions for which they are adapted physically; the part-time employment of high school and college students, and of businessmen—especially on week-ends and holidays; the relaxation of normal age limits, both upward and downward; the lowering of physical requirements, within limits; the retention in service of those reaching retirement age, if physically fit; the more widespread and intensive use of power tools and work equipment; and requests for the deferment of their most important, or key men, from military service. The means by which one road is securing thousands of man-days of effective track work through the week-end employment of students, businessmen and otherwise unemployed persons, is described in this issue and gives point to the contention that in the face of the present and contemplated manpower shortage, no expedient to increase the effective man-hours of the track forces should be discarded without the most careful study and investigation.

To secure and to hold sufficient forces to carry out the important task of maintaining the fixed properties of the railways adequate to the needs of the country's war effort should be the No. 1 consideration of every maintenance officer. If he recognizes this, and acts accordingly, he is certain to mitigate all of the other problems with which he will be confronted in the months ahead. If he fails to see labor as his No. 1 problem, and fails to act accordingly, he may well find many of his other problems insurmountable.

Cars—

They Must Not Remain Under Load

MANY of the duties and responsibilities of maintenance officers have grown to new importance during recent months and many problems have arisen to demand their attention. None of these responsibilities is of more importance, however, than that of making certain that cars containing company material are released promptly. While the railways are by no means at the breaking point, they are laboring under the serious handicap of being compelled to handle an abnormally heavy traffic with an insufficient number of cars, measured by almost any standard.

They have been able to do this to date only because they are receiving wholehearted co-operation from the shippers with respect to the loading and unloading of cars. As a result of this co-operation, cars are being loaded more heavily and nearer to capacity today than ever before, so that fewer cars are required to move a given tonnage. Likewise, the prompt release of cars upon arrival provides, in effect, more cars for loading. So well is the need for the quick release of cars understood by shippers that each of their regional associations maintains a vigilance committee to police the unloading of cars, and the results demonstrate that they are doing the job thoroughly.

Obviously, the railways cannot afford to do less than their patrons in releasing cars to make them available quickly for further loading, in loading them to capacity or in keeping them on the move to destination after they are loaded. Aside from locomotive and power-plant fuel, the maintenance of way department is the largest shipper and receiver of company materials, for which reason a large responsibility rests upon the officers of this department to insure that cars containing such shipments are loaded correctly and released promptly. Yet despite the importance of prompt release, a recent check disclosed unwarranted delays in the release of cars, amounting on one road to more than 16,000 car days, with delays on other roads ranging up to 12 days, for a total of almost 10,000 cars containing maintenance materials.

It requires constant vigilance and a large measure of persistence to get company material unloaded, especially when the railways are as busy as they are now, and particularly if the unloading must be done out on the line. But because they are busy, the need for the cars is greater and the responsibility of every officer, from foreman to chief engineer, becomes correspondingly greater. None should need any prodding to perform this necessary and important task, but each should take the initiative and carry on a continuous and aggressive campaign that will insure prompt release of all cars for which he is in any way responsible.

Hundreds of Non-Railroaders, Help Fill the Breach

Palo Alto (Cal.) Businessmen and Students from Stanford University Doing Week-End Work Laying Rail on the Coast Division

A PLAN that didn't seem possible of achievement a short while ago—that of employing non-railroad, "white-collar" workers and students effectively in track maintenance work to help offset a serious shortage in regular track labor, is today in effect with a large degree of success on the Pacific lines of the Southern Pacific, as each week-end and holiday, hundreds of high school and college students, teachers and professors, workers representing nearly every type of business and profession, and some railway employees from other than the track department, are aiding the depleted track forces in a wide range of constructive, essential work, including the laying of rail. For more than four months, the Pacific lines of the Southern Pacific have demonstrated the practicability of the plan, at least in their territory, a plan that has already seen more than 30,000 man-days of effective extra labor help build strength and stability back into seriously war-worn tracks.

Month after month following the outbreak of the war in the Pacific, the track labor problem on the Pacific lines became progressively worse, until at the turn of the last year there was a shortage of nearly 4,000 men in the ranks of the maintenance of way forces, with the prospect that it might become still worse as the year progressed. Of the more than 10,000 former employees of the road now in military service, several thousand volunteered or were called from the track forces; other hundreds left for work in the war plants with which the Pacific coast abounds—and all at a time when the railroad was carrying a war-born traffic, both passenger and freight, surpassing all previous records as to volume and intensity.

The road's attempt to bring several thousand colored workers from the Southern states was not successful. Where could it look for help in an area which it was reported currently was in need of many thousands of additional employees for shipbuilding and other war-time industries?

Awaiting the migration into the area of suitable workers, the most feasible answer to the railroad's track labor problem, even if only a partial answer, appeared to lie in the spare time of thousands of otherwise employed citizens—week-ends and holidays—if they could be induced to accept employment.

First Experiment

That, through patriotism, pride in an opportunity to work for a highly respected institution in their midst, an opportunity for healthful exercise, and a chance to earn additional money, they could not only be induced to work, but were in many cases eager for the opportunity, was first demonstrated in a sizeable way in the freight-handling department at Oakland, Cal. Here, confronted with a shortage of about 100 men daily to handle the record volume of business

Working Week-Ends, in S. P. Track Forces

Labor for Victory

No. 1 of a Series

Students, professors, businessmen, professional men and just John Q. citizens, at widely scattered points on the Pacific Lines, are putting in thousands of man-hours on Saturdays, Sundays and holidays to help offset an acute shortage in trackmen. This article tells of the need, the appeal and the response, and of the effective work, including rail laying, being accomplished by these part-time workers

flowing through the local freight station, appeal was made for week-end workers among the company's freight office employees at Oakland, to employees in the general offices at San Francisco, and through the local freight agent at Davis, Cal., 75 miles away, to the businessmen of that community. Would they help the railroad move its war load? That they would is seen in the fact that on the first Sunday following the call, 17 from the Oakland district freight office, a number of traffic men from the general office, and 41 businessmen from Davis, volunteered to help.

Imbued with the realization that they were aiding the war effort, work was spirited and efficient, and was carried out safely. In fact, it is said that as much freight was moved that day as is moved normally when a full platform crew is on hand. The experiment had not only worked, but the men came back the following week-end with new recruits. Furthermore, aided by publicity, it spread to other points on the road with success.

Idea Expanded to Track Work

If this plan would work in freight houses, why would it not work with equal success on the track—was the logical question raised by engineering and maintenance officers of the road, equally or more severely pressed for labor. Why not increase its appeal to the large number of students in the high schools, colleges and universities along the line—some of whom had already been induced to work on the track—as well as extend the appeal to businessmen? With the pressure lifted temporarily from the Oakland freight house, the businessmen from Davis were eager to work on the track. Likewise, a call by the agent at Palo Alto, Cal., the seat of Leland Stanford University, brought out a sizeable group of students the first week-end and a larger number the following week-end. The expanded idea was a success from the start, and, stimulated by publicity stories and advertising in local newspapers, it spread rapidly to different towns along the line.

For the three-day holiday week-end of February 20 to 22, approximately 3,300 man-days were worked by the "white-collar" trackmen—and this, in spite of inclement weather. During the week-end of March 6 and 7, the number of man-days of part-time workers employed on the track numbered 2,988, including 1,317 on Saturday and 1,671 on Sunday. Analysis of the employment figures for this week-end, which are largely typical of those for subsequent week-ends, shows both the scope of the plan on the Pacific lines and the diversity of occupations from which the part-time workers were drawn. This shows that on the two days of this week-end (March 6 and 7), 132 man-days were put in by businessmen; 68 man-days by professional men; 2,415 by students; 27 by teachers and professors; 329 by men with no full-time occupations; 2 by furloughed soldiers; and 15 by company employees from other departments. It also shows that the plan was in effect on all 10 operating divisions of the Pacific lines, as well as on the Northwestern Pacific Railroad and the San Diego & Arizona Eastern Railway. Of the total man-days employed on the March 6 week-end, 388 were put in on the Western division; 222 were put in on the Sacramento division; 120 on the Salt Lake division; 504 on the Shasta division; 242 on the Portland division; 702 on the Coast division; 165 on the San Joaquin division; 247 on the Los Angeles division; 108 on the Tucson division; 34 on the Rio Grande division; 185 on the Northwestern Pacific; and 71 on the San Diego & Arizona Eastern.

Students Predominate

As might be expected, students predominated among those employed, with the largest number, 595, prin-

Stanford University Students and Instructors Signing Up for Week-End Track Work at the Palo Alto, Cal., Ticket Office

Left Above—Businessmen from Eugene, Ore., Work Week-Ends on Southern Pacific Tracks. Left Below—Fresno (Cal.) Businessmen Working on Yard Tracks on Sunday

cipally from Stanford University, seeking employment on the Coast division, and 271 on the Western division, which takes in Berkeley, Cal., the location of the University of California. However, the employment of students was not confined to these divisions alone, they having been employed on every one of the other divisions in numbers, for the two days, ranging from a minimum of 30 on the Rio Grande division to 377 on the Shasta division. From December 25, 1942, to and including March 7, 1943, students accounted for a total of 15,219 man-days on the Pacific lines as a whole.

At the same time, on the week-end of March 6, businessmen were employed on seven of the ten divisions of the Pacific lines, professional men were employed on four of the divisions, teachers and professors on seven of the divisions, and unemployed citizens on seven of the divisions. In the face of such a record, it is evident that the appeal of the plan has not been confined to any locality or division; and that it has grown progressively is seen in the fact that on subsequent week-ends the total number of man-days of employment of these part-time workers has risen to as high as 4,000, with the prospect that it will rise still higher with better weather conditions during the summer months.

Advertised for Workers

To broadcast its appeal for part-time workers, the railroad has been employing advertising in local newspapers along its lines, asking those interested to contact the local station agent or roadmaster, as appears advisable in each specific locality. Upon making application, the applicants are observed for their general condition, and, if qualified physically, are registered and told when and where to report for work. Under relaxed age limit requirements, men are hired as young as 18 and as old as 60. No detailed physical examination is required, but those accepted must appear physically fit.

Classed as Section Forces

All of the part-time workers are employed as section men at the prevailing section gang rate of pay for 8 hours on Saturdays, with time and one-half for any hours worked in excess of 8 hours on Saturdays and for all hours worked on Sundays. Depending upon circumstances, the men are taken to and from points of work on the track in automobile trucks owned and operated by the maintenance of way department, or on section and extra gang motor cars with the regular track forces.

Full recognition is given to the inexperience in track work of those being employed on a part-time basis—also to the fact that many of them are not hardened physically to perform the heaviest operations at first. However, no attempt is made to coddle any of them. From the start, working along with and beside experienced trackmen, under the immediate supervision of regular foremen, roadmasters, assistant engineers and other supervisors, they are expected to do a good day's work on the operations assigned.

Do Many Classes of Work

To date, the character of the work on which the extra forces have been employed has been limited more by the operations required in the various localities than by any other considerations. In fact, there are few maintenance of way operations in which they have not been employed, their work already having included surfacing track, dressing ballast, cleaning cinders from the centers of tracks, laying rail, installing switches and renewing ties, with every expectation that they will be employed in other operations as the need arises. In the various operations, regular experienced employees operate most of the machines involved, such as cranes, power tampers, adzers, etc., but aside from that, the extra help, with shovels, picks, bars, wrenches and spike mauls fill out the operations, and week-end after week-end come back for more. To date, the record shows that approximately 65 per cent return for week-end employment.

No special training is given to any of the men before they start work, but under the watchful eye of foremen and roadmasters, who explain, demonstrate and caution where necessary, the men are said to work well and safely. Section foremen describe the work of the men as satisfactory and a big help in completing essential tasks. The men themselves say they consider the spare-time job a real opportunity to help speed the war effort; an excellent way to keep themselves in good physical condition while confined in offices and classrooms during most of the week; and as a worthwhile opportunity to earn extra money.

The management of the railroad is well pleased with the results that are being accomplished, and especially with the spirit that prompts these men to come to its assistance, but emphasizes that with a current shortage of approximately 4,300 in the regular maintenance of way forces, the use of the "white-collar" workers and students part-time is in no sense a complete answer to the need for adequate regular forces to keep the tracks in condition to handle the increasingly heavy war traffic of the road.

The employment activities described, insofar as they apply to the maintenance of way forces, are under the direction of W. H. Kirkbride, chief engineer of the Pacific lines, and F. L. Guy, engineer maintenance of way and structures.

A Foreman Should Know—*

By C. R. Taggart

Supervisor Bridges and Buildings,
C. C. C. & St. L., Indianapolis, Ind.

IT IS impossible for anyone to tell a foreman all that he should know in order to discharge all of his duties properly, for the work he may face next week may present new problems. It takes years of experience to acquire the knowledge necessary to enable him to do exactly the right thing on all the numerous jobs and in all emergencies.

The foreman should make an effort to learn everything there is to know about his particular line of work. He must know what is going on on his section, district or territory and he should be in a position to answer any question and give any information pertaining to his work, whether it relates to a job being done now, a job that has been done or some future project. An alert foreman can give his supervisor almost any information that is asked. He can advise and instruct the men in his gang as to the proper and safe way to perform any work that is new to them. No matter how new a particular kind of a job is, the progressive foreman will inform himself before starting the work. He can talk things over with his supervisor and ask his advice when he faces something unusual. It is better for him to ask his supervisor about the things he does not know than to take a chance and do something wrong which will give the supervisor reason to correct him.

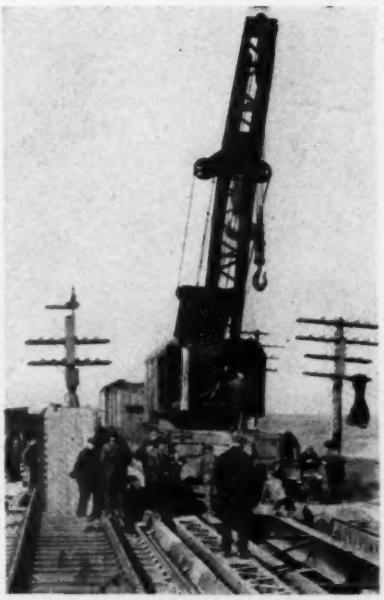
All foremen should know that their gangs comprise the foundation of safety in railroad transportation. The firmness of that foundation is established by the attitude of mind of those who direct its building. This applies not only to the construction and maintenance of safe track, bridges, signals, etc., but to the degree to which the foreman recognizes and discharges his responsibility for training and directing safe men. The foreman who builds a safe gang and maintains the principle of safety throughout the proper performance of every duty will certainly build a reputation for producing both safe men and safe structures.

The foreman should know that his company desires that he should always think of the safety of his men as well as of himself, and teach his men to look for unsafe conditions and take proper measures for their remedy. The foreman should insist and see that his men wear goggles wherever there is risk of an eye injury, and all injuries, no matter how trivial, should be given proper attention at once.

The foreman should know that he must set a good example for his men by being orderly in his habits, not losing his temper, and by being cheerful, hopeful, useful and careful. He should always make some allowance for the other man's limitations or weakness.

The foreman should know that it is a good trait to develop ability to make decisions promptly. This does not mean that he will make a hasty decision without the proper knowledge of the facts. Decisions that are delayed too long after the facts are known are usually no better and often not as good as decisions made while the problems are fresh in mind. The foreman must know that to hold the respect of his men he must be capable of making the proper decision at the time and instruct the men how to do the work. The only way to know how to instruct the men properly is for one to be familiar with all of the work himself. A foreman will never develop a good gang of men from new or inexperienced men if he does not know the proper way of doing the work himself. He must know more than enough to tell the men what to do; he must know enough to tell them how to do it.

A foreman should keep in mind that the company is always looking for men it can promote. That is, it wants men who can be promoted with the assurance that they will handle new jobs successfully, without loss to the company and without causing their superior officers additional worry and trouble. It costs money when a man fails, not only to the man himself but to the company as well. It is this loss to the company that the officials endeavor to avoid when selecting men for promotion. The man who desires promotion must prove that he is an asset and not a liability to his company,



"The Foreman Who Builds a Safe Gang Will Certainly Build a Reputation for Producing Both Safe Men and Safe Structures"

and the only way that he can do this is by the manner in which he handles his work. To progress, it is not only necessary for him to be capable and industrious in filling the job to which he may be assigned, but he must make his work so outstanding that it will attract the favorable attention of those on whom he must depend for promotion.

A prominent railway officer states that one of the best ways to attract attention is to develop a command of good English. No matter how intelligent a man is or how thorough his knowledge of the subject may be, his superior officers cannot feel that he is well informed or thoroughly versed in the particulars of his work, unless he can convey to his listeners a clear and understandable picture of his subject through the medium of language. He must be capable of using language that is so clear that his meaning is grasped instantly.

Must Have an Open Mind

A foreman must realize that he must keep abreast of the times and must have such an open mind that he can learn from even his lowest rated men. The men in the gang often have valuable ideas and knowledge, gained through long years of close association with their particular problems. The foreman who gains the confidence of the men in his gang has access to a fund of information that will be most helpful to him, while the men will appreciate his open-mindedness and be more likely

(Continued on page 363)

*Presented before the Association of Maintenance of Way Foremen of the Big Four Railroad.

Tie Saws— Speed Up

Above—Three of the Four Saws Used by a 58-Man Tie Renewal Gang Near Mauston, Wis. Right —Close-Up of a Saw in Action

IN 1940 because of the increasing difficulty in holding men in the extra gangs doing tie renewal work, the Chicago, Milwaukee, St. Paul & Pacific decided to try the Woolery tie saws, with the idea of reducing much of the heavy, burdensome labor involved in the old digging-in method. A 10-day trial showed satisfactory results. At the beginning of the 1941 season one tie gang was equipped with four saws and later in the season two additional tie gangs were equipped with four saws each. In 1942 a fourth tie gang was equipped with four saws. The principal benefits from the use of tie saws, as shown by one fairly normal season's performance (1941) were:— (1) Elimination of much heavy, burdensome work, making it easier to hold men; (2) less disturbance to the roadbed, leaving better riding track; and (3) cheaper costs for tie renewal work.

Two Sizes of Tie Saw Gangs

On the Milwaukee, in 1941, about 20 per cent of the total tie renewals were made by tie gangs. As a general rule, tie renewal gangs are not used where the renewals average less than 175 per mile. The gangs using the tie saws are employed principally on high speed main lines, and more particularly on those lines over which the streamlined Hiawatha trains operate (between Chicago and St. Paul, Minn., and Chicago and Omaha, Neb.)

In performing this work with tie saws, 66-man gangs are used on tracks laid with heavy rail and double-shoulder tie plates, while 58-man gangs are used in territories laid with lighter rail and single shoulder tie plates. During the 1942 season, a program was set up, assigning work to four tie saw gangs as follows: Gang No. 12, with 58 men, 195.3 miles of track on double track territory, inserting 56,013 main line ties in 83 working days; Gang No. 13, also with 58 men, 167.7 miles of track on double track territory, inserting 38,783 main line ties in 56 working days; Gang No. 20, with 66 men, 258.3 main track miles (mostly double track), inserting 79,759 main line ties in 119 working days, and Gang No. 10, with 64 men, 49.7 main track miles of double track territory between Chicago and Milwaukee, Wis., on the Milwaukee division, inserting 16,155 main track ties in 27 working days. The latter gang was then increased to 76 men and assigned 117.4 miles of main track on the Superior division, inserting 37,198 main track ties in 62 working days. This gang also did spotting and lining work on the Superior division.

All of this work was in gravel ballast. All gangs worked eight hours per day, although working hours were occasionally adjusted because of train movements. As soon as the gangs completed their tie assignments for the season, they were transferred to ballasting or surfacing work and the tie saws were shipped to other large tie renewal gangs on the system.

Ties are distributed by section gangs a few days before arrival of the tie gang, using a heavy-duty motor car and heavy duty push cars. The ties are placed workwise on the subgrade shoulder at the point where they are to be used, but out of the way of the men removing the old ties. Occasionally ties have been distributed directly from work trains, but the Milwaukee's experience in distributing ties in this manner has not been very satisfactory, and, because of the present shortage of cars and motive power, the use of work trains for this purpose has been discontinued.

Operations

In double-track territory the tie saw gang operates on one main at a time, usually against traffic. It is supervised by a general foreman, an extra gang foreman and two assistant foremen. The general foreman is in charge of the entire gang. The extra gang foreman and one assistant fore-

Renewal Work— Provide Smoother Track with Less Labor

After an extensive trial of tie saws in its tie renewal work, the Chicago, Milwaukee, St. Paul & Pacific equipped four large extra gangs with these saws, using these gangs to make many of the tie renewals on its high-speed main lines. By the use of tie saws, tie renewals were speeded up with less burdensome work, better riding track was secured because of a minimum disturbance of the tie bed, and sufficient savings realized to pay for the saws in two years

man divide the field supervision of the gang, while the other assistant foreman serves as a motor car operator.

In detail, the operations of a typical 58-man gang are as follows: One or two men pull spikes with claw bars. One man removes anticreepers bearing against ties to be renewed and piles the old spikes removed by the spike pullers. Four men with spoon bars, two on each rail, dig out on each side of the ties at the point where the tie saw will cut the ties. These men sometimes use picks instead of spoon bars, depending upon the condition of the ballast, and occasionally an extra man is required to loosen the ballast at the ends of the ties.

This group is followed by the four tie saws, two on each rail, each operated by one man. A machine operator accompanies the tie saws, supervises the cutting, sees that they are in working order, makes minor repairs, assists in removing them from the track, etc. The spoon bar men also assist in removing the tie saws from the track and in putting them back on again. Each tie saw makes a cut in every alternate tie to be removed. They are spread out sufficiently to avoid interference and delay to operations but remain fairly close together, so the men can assist one another in putting the saws back on the track after a train has passed.

Two bar men with lining bars pry the short ends of the ties from under the rails without removing the plates, while another man with a lining bar nips the rail on an adjacent tie. This is usually done without digging out at the ends of the ties. One man with tie tongs helps pull the pieces out and places them on the subgrade shoulder. These men also pry out the middle piece, which is also placed on the sub-

Left Above — The Specially - Built Light Weight Push Car on Which the Power Unit for the Tampers Is Mounted. Below—Close-Up of Tampers

grade shoulder. On heavier rail, with double-shoulder tie plates, three men with a tie-plate fork nip the rail high enough to pry the ends of the ties out without removing the tie plate. The tie-plate fork is a long bar about 8½ ft. long with a triangular steel brace and two prongs on one end. The prongs are spaced wider than the width of a tie and are placed under the base of the rail on the gage side, with a prong on each side of the tie being removed. A contact point bears on the tie several inches from the rail and by bearing down on the end of the bar the rail is raised high enough to pry out the end piece without removing the tie plate.

After the old ties are removed, 16 men with picks, shovels and tie tongs dig trenches in the ballast shoulder at one end to permit inserting the new ties, clean out the old tie beds and place the new ties. The old tie bed is disturbed as little as possible, being dug to a depth sufficient only to enable the new tie to be inserted easily. Another man with a shovel backfills ballast on the shoulder and around the new ties.

Seven men follow, tamping up the new ties. These men are equipped with four Jackson electric tampers and a WS-4 Jackson electric power unit. Four of them operate the tampers and one pushes a specially-built, light weight push car on which the power unit is mounted. This push car and power unit can be set off the track anywhere by six men in 6 to 10 seconds. The other two men nip the ties for the tampers. The new ties are tamped solidly against the base of the rail before the tie plates are applied.

After the ties are tamped, two men with a tie-plate fork nip up the rail and one man applies the tie plates. On light rail, only one man is required to nip the rail with a tie-plate fork. Four spikers follow the tie plate men, spiking the ties on tangent track with four spikes per tie.

The work is completed by four men with shovels dressing track and reapplying rail anchors. In addition to the men mentioned above, one man with a push car distributes spikes ahead and then drops back and picks up the old spikes, putting them in kegs, which he sets beside the track when full. Four other men with a push car collect and dispose of the old ties, which are usually burned the same day unless local farmers or townspeople ask for them and arrange to pick them up promptly.

The gang travels to and from work on a motor car train, consisting of a heavy-duty motor car and three 20-men trailer cars. This train is operated by line ups and is in charge of an assistant foreman. One additional man accompanies the motor car train when operating on the main line. A tool man also accompanies the motor car train on some of the trips to help load the kegs of released second hand or scrap spikes and protect the motor car by flagging when necessary.

Two regular flagmen protect the gang, which operates under train orders restricting the speed of freight trains but not of first class trains. The flagmen place torpedoes and display a yellow flag to remind the enginemen of the restriction order. Since the gang can clear the track in 6 to 10 seconds, trains are not delayed appreciably, and the foreman usually gives the engineman a "high-ball" before the train is close, allowing him to begin picking up speed as soon as possible. The gangs clear the track of all on-track equipment 10 minutes ahead of all first class trains, except the Hiawatha streamliners for which the track is cleared 15 minutes ahead of the arrival time.

The tool man has an outfit car equipped with power grinders for sharpening the saw blades for the tie saws. He also straightens second hand spikes and the best of these are reused by the tie gang. Other second hand spikes are shipped to the stores department for use on side tracks and branch lines; the scrap spikes are also shipped in promptly. Each gang is equipped with a complete set of repair parts for the tie saws. A sufficient number of extra saw blades are carried on each saw to complete the day's work, while the tool man sharpens the blades used during the previous day.

The entire gang is housed in outfit cars, consisting of a tool car, a water car, a foreman's car, five box bunk or two coach bunk cars, a diner, a kitchen car and a material car. These outfit cars are moved by local freight trains and are set on house tracks or unimportant passing tracks near the work.

Costs

The costs of tie renewals with these gangs vary from 20 to 50 cents per tie, depending upon the class of line, the condition of the ballast, traffic interference, etc. In 1942, costs also fluctuated considerably, because of trouble in securing sufficient labor to keep the gangs filled. This condition was particularly troublesome during the latter part of the working season and in certain areas near war industries. Because of this, the costs in 1942 are not a fair or reliable indication of the efficiency of the work. In 1941, however, the Milwaukee secured a direct comparison of the cost of mechanized tie renewal methods with that of gangs not equipped with tie saws. This cost information was secured for each of two gangs before and after being equipped with tie saws, while continuing to operate in the same territory. In both cases the variable factors of different personnel and different track conditions were largely eliminated, thus giving as accurate a comparison of costs as it is usually possible to secure in maintenance of way work.

In 1941 one gang of 59 men started work without tie saws on the I. & D. division on April 16 and renewed 41,056 ties at an average cost of 29.38 cents a tie, not including the cost of distribution. On August 2 this gang, with the same foreman, was equipped with tie saws and during the remainder of the season it renewed 32,422 cross ties on the same division, at an average cost of 26.44 cents a tie, not including cost of distribution, saving 2.94 cents a tie with the tie saws.

Another gang of 51 men started work without the saws on the Iowa division on April 16 and renewed 26,956 ties at an overage cost of 35.27 cents a tie, not including cost of distribution. The same gang was equipped with tie saws on June 20 and renewed 62,879 cross ties on the same division during the remainder of the season at an average cost of 32.83 cents a tie, not including cost of distribution, saving 2.44 cents a tie with the tie saws.

This comparison of costs is not entirely fair to the saws because of the fact that hand methods were used during the spring and early summer when tie renewals can be made most easily and most efficiently by such methods, as compared to the latter months of the season when the weather is usually hotter and the ballast is dried out and does not work so easily. Yet, the savings realized with gangs equipped with saws, will pay for the saws in about two years.

As mentioned previously, the principal reason prompting the Milwaukee to use tie saws for renewals on high-speed main lines, is the fact that it enables them to be made with a minimum of disturbance to the old tie bed, which results in better riding track after the renewals are completed. The fact that the use of the saws reduces the amount of hard labor involved and helps hold men in the gangs, was another point favorably considered. For these reasons, the Milwaukee has been more than pleased with the work accomplished by its tie renewal gangs with tie saws.

The various tie renewal gangs on the Milwaukee work under the general supervision of W. G. Powrie, engineer maintenance of way, and under the direct supervision of the division superintendent and division engineer on each division.

"The Traffic Is Heavier Today Than It Has Ever Been Before—the Job in Other Words Is to 'Keep Them Rolling'"

The Maintenance Man's Responsibility In Time of War*

"If we have plenty of labor, we can get along with less material. But when both are scarce the problem is much more difficult," says Mr. Clarke, and discusses the tools for maintenance—"men, material and machines"—and how these must be utilized in spite of handicaps to keep the war traffic rolling

By H. R. Clarke,
Chief Engineer, Chicago, Burlington & Quincy, Chicago

THE MAINTENANCE man's responsibilities in time of war are the same that they were in times of peace; that is, to keep the tracks, the bridges and the property, in general, safe for the traffic they must carry. The only difference is that it is harder to do this. The job, in other words, is to "keep them rolling." The means we use, the tools at our command, are the same as they have always been—men, material and machines. So the real subject that we want to discuss tonight is the changes that may exist in those tools, the handicaps under which we may be working and how we can do the very best possible with the means under our control.

Maintenance men are used to doing without things. That is no new experience for us. We are always doing without things. In the past we had to go without materials because there was no money. Now the situation is changed and money is available but the things that that money will buy are not available. The traffic is heavier today than it has ever been before and there has also been a great change in the character of the traffic. Lines of comparatively light traffic have suddenly become important because of some large industry or camp. Other facilities, such as water and fuel stations, are being used far beyond the capacity for which they were designed. It is our responsibility to size up the situation, determine the conditions and then meet them. In other words, our first responsibility is to know our job thoroughly, which means that we should know the territories for which we may be responsible thoroughly.

In undertaking to do the job that is ours we must prepare a complete plan or program; this requires that we know all the things which ought to be done, and then make sure that every essential project is included in that program, so that we will have the entire picture before us. It is certain that we are not going to be able to do all of the things that ought to be done. Having the complete picture before us, our next responsibility is to select the things that we will be able to do in the order of their importance. That requires the exercise of judgment, for many times it is not going to be easy to decide which of several things may be most important.

I have said that the three tools we have to work with are men, materials and machines and that all of them are vital. It is difficult to decide which is the most important or which we should discuss first. With plenty of one we can get along with less of the other. If we have plenty of labor, we can get along with less material. But when both are scarce the problem is much more difficult.

I think that, perhaps, we should discuss the problem of men first because that is the most interesting. In that, we are dealing with our fellow workers, and perhaps it is the thing

*Abstract of an address presented before the Maintenance of Way Club of Chicago.

that we can do most about. It constitutes the real test of a leader. For three days I have been sitting in a conference with Gen McSherry of the War Manpower Commission discussing this problem of manpower as it affects the railroads and he gave us figures regarding the demands that will be made not only on the railways but on all industries. He did not mince words but endeavored to work out some kind of program with the representatives of the railways and of other industries which the War Manpower Commission might accept.

"Conditions in the Labor Market Have Changed Drastically — — — We Have to Teach, Train and Develop Men in Ways That Have Not Been Necessary During the Last 12 years"

Labor Conditions

I need not remind you that conditions in the labor market have changed drastically during the last year. For the past ten or twelve years labor has been plentiful and that is the condition that many of our men, who are now carrying the load, know best. Not long ago I was talking with the foreman of one of our extra gangs about the problem confronting him in maintaining his gang to full strength and discussing what might be done about it. "I used to fire more men in a day than I have in the gang now," he said, and I expect that statement is true. Anybody can fire a man but it requires real leadership, thought and ability to hire them today. This change in conditions means that we have to teach, train and develop men in ways that have not been necessary during the last 12 years. Our supervisors and roadmasters differ widely, of course, in their ability to get men, but, as they begin to get the idea that we want to carry out, some of them have been remarkably successful and have displayed a great deal of initiative in rounding up laborers. A great deal can be done, also, in caring for this labor. Good camp cars and good meals deserve more attention than we have given them for many years.

In the effort to recruit labor, we have been forced to do some things which we would very much have liked to have avoided. For instance, it has been necessary for us to lower our standards. We are now employing younger men and older men than were formerly acceptable. We are discontinuing our physical requirements, for we have to have labor, and if we had maintained our former standards, the situation would have been hopeless. Those things which have been done impose further responsibility on us. We know that the men we are now employing do not measure up to former standards and our responsibility is to so train them as to make the best possible labor out of them.

It is certainly right at any time and absolutely necessary at this time that we treat our men with absolute fairness. I have never found that labor resents rigid discipline, if fairly and impartially administered.

Another responsibility that might be given some consideration is the possibility of substitutions. What can we do to replace labor that is absolutely impossible to secure? Of course, as I have already said, if we have plenty of materials and plenty of machines, we can get along with less labor. There is, also, the possibility of substituting women in some positions, and as we have thought of this, it seems to most of us that we are not yet ready to use them in section gangs, steel gangs, etc.

Maximum Use of Equipment

About all that we can say in regard to the use of equipment is that we must use that which we have to the maximum. This includes double-crewing machines, which it has been our practice in the past to operate with one crew only, thereby working one piece of equipment two eight-hour shifts. We must see also that the equipment is kept in service every possible minute. One of the most important changes in viewpoint is to be more ready to share than we have been in the past. It is human nature to be a little selfish. If we have a machine that we do not need today, but may need tomorrow, we are inclined to leave that machine idle until we need it. It is certainly now our responsibility to forget selfishness and see whether a machine that we do not need for the moment may be more important somewhere else, and to offer to release it when we can get along without it for a while.

To meet the problem of materials simply means taking the best possible care of the materials that we are able to get and keep them moving. We should not order material before we need it and when we order it we should use it. There is almost no material today that is not scarce; almost everything comes in the category of critical. As this situation developed, the tightness showed up first in steel, copper and rubber, but one can now hardly name any item that is not on the critical list.

"We Must Use That (Equipment) Which We Have to the Maximum — — — and See That It Is Kept in Service Every Possible Minute"

Conserving Material

I shall not attempt to go into detail with respect to the many measures that we might adopt to care for material; rail, frogs and switches, for instance. One important thing that I

would like to stress, however, is the very serious and heavy responsibility that rests on track men to watch closely for damage to rail. The mechanical department is working under the same handicap that we are and equipment is making more miles per day than ever before. As a result, damage is more likely to result and we can assist greatly if we are continuously on the alert for damage to the rail, reporting it promptly and doing all that we can to identify the equipment that is causing it.

A few years ago the reshaping of angle bars was developed and I assume that you are all familiar with this possibility through grinding and reshaping the bar. It may not be quite the bar that we would like to have, but it is certainly better than none. We, certainly, are justified in going to greater lengths in reclaiming materials today. The question that used to confront us was whether it was economical to reclaim material. Now it is a question of whether we have material or whether we do not.

It is hardly necessary to speak about the need for care in the use of ties, for today the tie hacker in the woods can make better wages in a war plant. As a result, regardless of expense, it is again our responsibility to see that the utmost care is used in applying this particular item in our track structure.

Supply Men Can Help

In speaking to a group such as this, it is not out of place to refer to the part that railway supply men can play. They can help the railroads carry on in a very definite way. In fact, the supply man can be of more help to us now than when the situation was normal. I always knew how I could secure any item I wanted when it was easy to get, for I had only to reach for a telephone. Now, the supply man can tell us when shortages may be developing and suggest how we may substitute something that is not critical for something that we have been using. He can be of great help, also, in telling us of priorities.

A decided effort is being made to simplify and standardize specifications, and to a certain extent that is desirable. While some progress has been made in this direction, probably still more progress can and will be made, although that is not a measure which should be pressed too strongly at the present time.

As I said at the beginning, our responsibilities are of the same character as they have been through all the years—to keep the tracks and the structures safe for the traffic that they carry. They are just more difficult to measure up to. They will become still more difficult, but we can do much by working together. Each of us can give to the other the benefit of his experience with the things that he has tried that have worked, and with the things that he has tried which have not worked. The problem is that of working shoulder to shoulder and doing our job a little better than we have ever done it before.

A Foreman Should Know—

(Continued from page 357)

to willingly give full co-operation.

A foreman must understand that he is responsible for the proper conduct of the matters entrusted to him and must make his own decisions and handle his own affairs without much help or advice from his superior officer. He must feel that his superior officer has confidence in him and in his ability to do the work entrusted to him and that he will enjoy his confidence as long as his work warrants his being retained.

Most men enjoy authority. They realize that they are being put on their own mettle and resources, and they like to feel that the results that they are accomplishing are the products of their intelligence and effort. This is a natural and commendable attitude and is always encouraged by the superior officer who wants to make better foremen. This same idea works when applied to a man in the gang who is given responsibility. Most men would rather be trusted with a job to the extent of actually having the work to do, knowing that the foreman has given them something to accomplish without watching their every move. The foreman must know that men who are taught to wait for every command to move will not produce a full day's work any day.

A foreman, or any man in authority, must be very careful that mental laziness is not allowed to enter into his work. It can, and its presence is not readily realized. It is one of the worst handicaps known. It is a habit that grows and unless taken in hand and controlled early, it will stop any man's progress. The principal manifestation of this affliction is the inability to get things done at the proper time; the delaying of work for no good reason when a little energy and application would quickly solve what may appear to be mountainous problems. It is surprising how easily most things can be done when once attacked in the proper spirit.

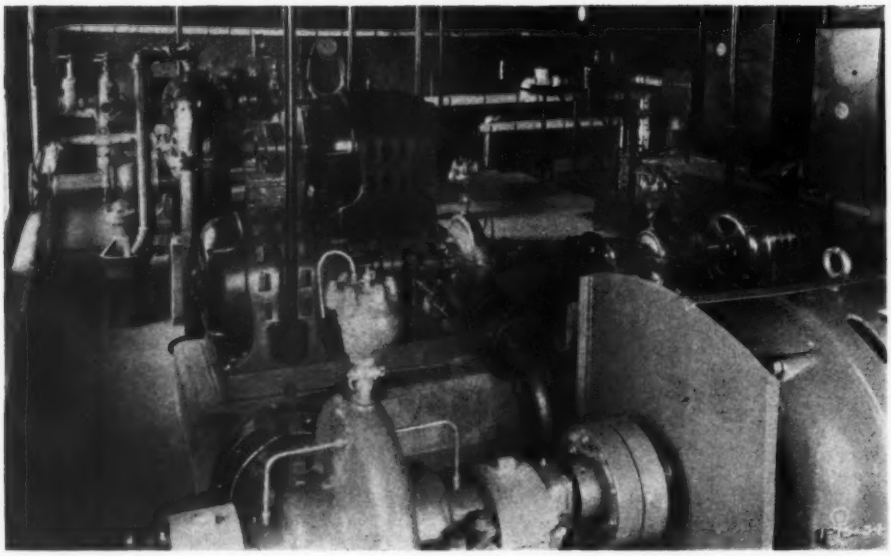
The successful foreman should remember that he was promoted to a very responsible job when he became a foreman. His next task is to try to hold that job successfully, and make preparation for the next better job. He should handle his job so efficiently, so economically and so entirely to the satisfaction of his superior officer that when they have occasion to look for a man to promote, they will be willing to bet their money on him to succeed wherever they put him.

TEN COMMANDMENTS
OF A
• SAFE SECTION MOTOR CAR OPERATOR •

1. I SHALL GET MY REST AND KEEP MY MIND ON THE JOB.
2. HOW'S MY WATCH? THAT IS VERY IMPORTANT. IS MY TIME CARD ON THE CAR?
3. NOW I SHALL SEE THAT MY FLAGGING EQUIPMENT IS ON HAND AND IN GOOD CONDITION.
4. HOW'S MY CAR? I SHALL CHECK MY CAR FREQUENTLY. MY BRAKES MUST BE IN GOOD CONDITION.
5. MY TOOLS MUST BE LOADED PROPERLY, SO THAT THEY WON'T FALL OFF AND CAUSE MY CAR TO DERAIL.
6. I AM READY TO GO, AS SOON AS I ASSIGN ONE MAN TO LOOK AHEAD AND ONE TO LOOK BEHIND SO NOTHING CAN SLIP UP ON ME. MY MEN MUST KNOW WHAT TO DO IN AN EMERGENCY.
7. I SHALL NOT KILL – THAT IS RIGHT – MYSELF NOR ANYONE ELSE, SO I WILL APPROACH ALL GRADE X-INGS WITH MY CAR UNDER CONTROL AND FLAG MOST DANGEROUS X-INGS.
8. I SHALL FLAG ALL DANGEROUS CURVES, BECAUSE MOST ACCIDENTS OCCUR ON CURVES. I SHALL STOP MY CAR FAR ENOUGH FROM CURVE SO MY FLAGMAN CAN FLAG WITH SAFETY.
9. I MUST SEE THAT MY CAR CLEARS NEAREST RAIL, AT LEAST 8 FEET, WHEN SET OFF TRACK.
10. I BELIEVE IN THE "GOLDEN RULE", SO I WILL NOT OPERATE MY CAR CLOSER THAN 300 FEET TO MY FELLOW EMPLOYEE'S CAR, AND I SHALL NOT PERMIT MY MEN TO GET ON OR OFF MOTOR CAR FROM SIDE WHILE THE CAR IS IN MOTION.

DIRECTOR OF ACCIDENT PREVENTION

One of the Monthly "Safety Prints," in Blue Print Form, Distributed Among Section Foremen on the St. Louis—San Francisco, for Posting in a Conspicuous Place



In the Last Few Years Marked Improvements Have Been Made in the Design of All Types of Centrifugal Pumping Equipment and in Electrification of Pumping Stations

Pumping Equipment

Shows Many Improvements

Because of technical advances that have been introduced over a period of years, modern pumps are better machines in many respects than those produced only a short time ago, as pointed out in this report of a subcommittee of the Committee on Water Service, Fire Protection and Sanitation of the American Railway Engineering Association. K. J. Wier, special water inspector, C.M. St. P. & P., was chairman of the subcommittee

"THE best pumping plant is none at all. If a gravity supply is available at reasonable cost, it is 'hard to beat'." This statement, made in 1901, in the first report on pumping equipment by the Water Service committee of the A.R.E.A., still holds true. Since that time the committee has submitted nine reports on this and allied subjects that cover the development of many types of pumps, including air lift, reciprocating, turbine, centrifugal, propeller, and deep-well turbine units, and the use for power of men, horses, windmills, natural gas, steam, kerosene, gasoline and electricity. In the intervening 41 years, pumping equipment has been developed, along with all other mechanical devices, to the point where equipment has been produced that is capable of operating at capacities, heads, and efficiencies that were then thought impossible. The use of automatic controls likewise has increased to a seemingly unlimited field of application.

The standards of the Hydraulic Institute classify pumps in the four general groupings as shown in the accompanying table.

In the last few years marked improvements have been made in the design of all types of centrifugal pumping equipment. By increasing the speed to 3,500 r.p.m. it has been possible to effect reductions in impeller diameters and in the size of pump casings, while increased pump efficiencies have been obtained by improved impeller and casing design. One recent development has been the motor pump which is a compact, self-contained centrifugal pump having the motor rotor and pump impeller mounted on the same shaft. This pump operates equally well in any position and requires no special foundation. It is available in units ranging from one gallon per minute up to 1,000 g.p.m. operating under variable heads up to 280 ft. The larger units are advantageous in that they require less space for installation than the regular side-suction and discharge types.

Another adaptation of the centrifugal pump is the "ejector" or "jet booster" for use in both shallow and deep wells. With this unit, the suction port of the pump is connected to the discharge end of a small venturi tube placed at the proper depth below the water surface. A portion of the water drawn from the well is directed back into the throat of the venturi at regular pump discharge pressure, creating a suction which lifts additional water from the well. The pump itself need not be located directly over the well, but may be placed a reasonable distance away where shelter is available. At the present time the capacities and heads of this pump are relatively low, but these will no doubt be increased.

Portable gas-engine-operated centrifugal pumps for low heads and capacities up to 1,500 g.p.m. have been developed in recent years and are particularly useful for emergency work in pumping flooded pits, basements, etc. Also, portable electrically-operated low-head small-capacity centrifugal pumps, small enough to be held in the hand, are now available for pumping special chemicals. These are made largely of stainless steels, glass, stoneware, or plastic materials.

Possibly the greatest improvement has been in the use of the propeller-type centrifugal pump for exceptionally high-capacity service at low heads. Examples of this class of service include the 1,500-cu. ft. per sec. pumps at Mill Creek, Cincinnati, Ohio, and pumps of similar capacity

at New Orleans, La. Both of these installations were designed for flood-control and drainage service. At the same time single-stage centrifugal pumps have been improved for greater capacity and higher-head requirements, such as those that are operated by the metropolitan water district of Southern California, which deliver 90,000 g.p.m. against a total head of 440 ft., and require 12,500 hp. each for operation. The recent improvements in centrifugal pumps may be summarized as follows: (1) Increased efficiencies; (2) a tendency toward higher speeds; (3) greater capacities; (4) higher total heads; (5) reduced weights; (6) standardization of ball bearings; (7) use of stainless steels, glass, stoneware, plastics, etc.

Hydraulic Institute Classification of Pumps

- Centrifugal
  - Centrifugal — Single Stage / Multi Stage
  - Propeller
  - Mixed Flow
  - Peripheral
- Rotary
  - Cam
  - Screw
  - Gear
  - Vane
- Reciprocating
  - Piston / Plunger
    - Direct-Acting Steam — Single / Duplex
    - Crank and Flywheel
    - Power — Single / Duplex / Triplex
- Deep Well — Turbine

Rotary Pumps

The Moyneau (French) or Moyno (American) rotary pump was introduced in this country about 1930. It is a positive-displacement type unit consisting of an alloy helical screw rotor, directly connected to a motor shaft, which revolves in a fixed stator usually constructed of hard rubber. As a horizontal pump it has been particularly adaptable for pumping many types of chemical solutions, semi-solids, and some types of dry materials. As a vertical pump it has filled a long-felt requirement for a deep-well pump of relatively low delivery for wells too small in diameter to permit the use of conventional deep-well turbine-type equipment. Capacities for this service range from 8 g.p.m. to 60 g.p.m. and the total heads approach 1,000 ft., with pump settings as deep as 900 ft. below grade. This is the outstanding rotary pump development in recent years.

There have been few recent improvements in reciprocrating pumps. Such pumps are bulky, more expensive initially, and less adaptable to numerous present-day requirements in water service than the centrifugal, rotary or deep-well turbine pumps. Where electricity is not available and manual attendance is required for pumping operations, the reciprocating type unit, however, may prove to be more economical over a period of time.

Small piston-displacement pumps of capacities as low as 0.03 g.p.m. are now available, principally for pumping chemicals. These can be secured in groups of two or more pumps driven by a single power unit, thus permitting the feeding of several different chemicals at once.

Many Roads Have Installed Unhoused Deep-Well Turbine Pumps With Automatic Controls

Deep-Well Turbine Pumps

Deep-well turbine pumps were first used in irrigation work about 1910. Their development since that time has been represented by a continuous improvement that has taken the form of higher efficiencies, higher heads reflected in deeper settings and larger capacities. During the last 10 years efficiencies have been stepped up from between 10 and 15 per cent to almost 80 per cent; total dynamic heads have increased from 650 ft. to over 1,000 ft.; pump settings have been lowered about the same amount; and capacities have been increased from 6,000 g.p.m. to 15,000 g.p.m. One unit in service for the last four years has a delivery of 12,500 g.p.m. against a total head of 674 ft. at 1,750 r.p.m. This type of pump, while generally used for pumping deep wells, is very flexible in design and is adaptable for many other pumping services, including the handling of oil from tanks, fire protection, hot-well service and pumping from streams or lakes.

Water-lubricated turbine pumps have enjoyed widespread use in the last few years. In this type, all of the vertical shaft and pump bowl bearings are constructed of wear-resisting cutless rubber, which eliminates the use of oil for lubrication and the shaft oil tube extending to the lower pump bearings. These bearings are fluted to provide full water lubrication for the shaft and sleeves when the pump is operating, and to disperse sand or gritty materials away from the shaft to avoid cutting. Such pumps normally operate at 1,750 r.p.m. and can be considered reliable units that are adaptable for automatic control, as no attendance is required for lubrication.

The submersible-motor deep-well turbine pump has been improved during recent years and can be considered a dependable pump, especially for the deeper settings. The bowl assembly and electric motor of this pump are built together and are submerged at the lower end of the pump column at the proper working depth in the well. Power for operating the pump is transmitted from the surface of the ground to the motor through metal-protected waterproof cables attached to the column pipe. The motor is designed for underwater service and is provided with a mercury seal to exclude water from its working parts.

(Continued on page 369)

A Power Unit with a Capacity of Two K.V.A. That Is Used Quite Widely for Surfacing and Spot Tamping

Portable Power Plants and Tools Find Many Uses

The extensive adaptability of electrical outfits, their advantages, and some of the factors to be considered in determining the size of the generator to be used, are among the matters discussed in this abstract of a report prepared by a subcommittee of the Committee on Maintenance of Way Work Equipment of the American Railway Engineering Association. C. E. Morgan, superintendent work equipment and track welding, Chicago, Milwaukee, St. Paul & Pacific, was chairman of the subcommittee that prepared the report

THE use of small portable electric power plants in maintenance work has become so general that it is well to take note of their extensive adaptability. Certain machines of this type are used in large numbers. Tie tamping machines, with vibratory three-phase tools, comprise one example, the sizes used ranging from 2 to 5 kva. Five years ago, 5-kva. machines were used in the greatest numbers, but during the last two years the 2-kva. outfit has made an invasion into this field. The latter machine will operate four tampers and is used in small gangs. It is more readily portable and provides greater flexibility.

The portability of the power plant is one of the features that has brought the use of electric tools into favor. For this reason it is often desirable, where a considerable number of tools are to be used, to provide two or more plants of not more than 5 kva. rather than a single one of larger capacity. This arrangement also gives greater flexibility.

Use by B. & B. Gangs

Railroad bridge and building crews employ many electric tools and can use to good advantage a 5-kva. unit which will handle such equipment as a chain saw, a 12-in. circular hand saw, a nut runner-up to the one-inch size, ¾-in. electric drills, concrete vibrators and lag-screw drivers. Where chain saws are not used and where only smaller tools, such as ½-in. electric drills and small nut runners, are employed, the crews may be equipped with power plants of 2 to 3 kva. Such machines also make good portable units for supplying power for flood lighting. Building repair crews that have no heavy frame work, and for which an 8-in. cut-off electric rotary saw is adequate, with other tools in proportion, find a 2-kva. unit large enough. The lack of speed control may handicap some users of electrical tools in drilling operations, such as are required when making repairs to steel bridges, and where air is used in riveting it continues to be favored also for drilling.

Reciprocating electric tamping tools are also used, and these require that the alternating current supplied by the generator be converted to direct current. The generators of 6 to 12 kva. are 110 volts, 3-phase, and will operate a large variety of tools. It is a well established fact that there is less friction loss in rotative tools than in tools of a reciprocating design. They likewise have better torque or turning characteristics in that the turning action is steady, while reciprocating tools impose a series of impulses with each revolution.

The generators used range in size from 2 to 15 kva., but those from 2 to 5 kva. seem to be the most popular sizes. Most rotary tools used with portable plants are so designed that they can be employed with either alternating or direct current. Most of them are 110-volt tools so they can also be used where commercial circuits supplying 110-volt alternating current are available.

Portable power plants are used for sources of electricity for concrete vi-

brating and finishing, sawing, drilling, dapping, nut running and lighting. Arc-welding machines are used extensively in making bridge repairs and to replace metal worn away on frogs, crossings and rail ends. The open-circuit voltage of most welding generators will be 80 to 95 volts, thereby affording a source which can be used for small 110-volt tools not drawing much power. Some welding generators have a 110-volt winding for auxiliary tools. Such machines will handle both auxiliary loads and welding at the same time.

Manufacturers of electric drills usually make two or three grades of tools, that is, for light, medium and heavy work. Where the work is on a production basis, the heavy-duty drill should be chosen. While the size rating of a drill is based on its capacity in steel, and the capacity in hard wood is usually given as about twice that in steel, it should be remembered that boring in hard wood, especially when green, constitutes very severe service, and the drill chosen for such work should not generally be smaller than its rated capacity in steel. A drill of even larger capacity will be found to give longer life and more satisfactory service. If proper consideration is given to the selection of a tool of proper size for the job, and that tool is not overloaded and is properly lubricated and maintained, it will give many hours of satisfactory service. To obtain desirable results, responsible, capable and properly trained men should be placed in charge of all power tools.

In determining the size of an alternating current power unit required for the operation of a given number of tools of various kinds and sizes, it must be remembered that the power load rating of an alternator is approximately 20 per cent less than its lamp load rating. Hence, it is necessary that the combined load rating of all the tools to be used at the same time shall not exceed approximately 80 per cent of the lamp load rating, which is the rating ordinarily given by the manufacturer. Thus, in the case of a 5-kva. alternator, the load should not exceed 4 kva., and for a 2-kva. machine, it should not exceed 1.6 kva. This rule does not hold for direct-current generators, which may be loaded to their full rated capacity. It is necessary to know the ampere rating of the various tools so that the total load resulting from the use of tools in combination can be approximated.

The power required for the operation of various electric tools cannot be ascertained definitely; different manufacturers give different ratings for tools of approximately the same size. The values given below for a few commonly used tools are not to be considered exact but may be employed for estimating purposes.

Flood Lighting

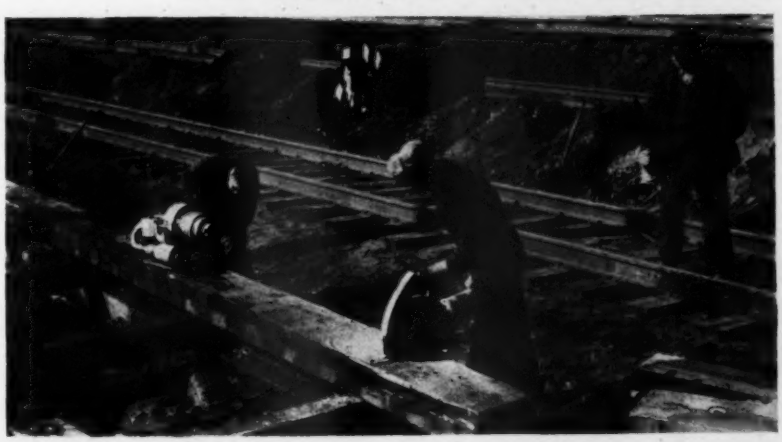
One of the most important and satisfactory uses of portable electric power plants is that of flood lighting at wrecks where tank cars containing gasoline or oils may be involved and open lights are not permitted. One railroad provides the locomotive wrecker train on each division with an 800-watt alternating current power plant with a pipe frame having carrying handles. In a tool box equipped for two men to carry are two floodlights of 250-watt size and two 100-ft. extension cords with sockets and plugs. Each floodlight has a 50-ft. cord. If there is track work still to be done at the time that the wrecker leaves the job, the units are left until the track is made safe.

The apparent reason for the increase in the number of electrical units used in recent years is to enable more work to be accomplished by the same number of men, and the present labor shortage has given additional impetus to this incentive. To illustrate the results accomplished, a number of examples will be cited from a survey made on railroads equipped with such machines. In one instance, a man with a 2-kw. plant and a cutoff saw completed more framing than five men with hand saws. Again, one man drilling on a bridge with a ¾-in. heavy-duty drill completed more holes in one hour than four men with hand tools. Two men on the same job drove more lag screws with electric drivers than 10 men with hand wrenches.

Approximate Power Rating and Speed of Various Tools

Tool	Ampere Rating	Kva. at 110 Volts	Load Speed RPM
½-in. heavy-duty drill	5.0	0.55	350
¾-in. heavy-duty drill	8.0	0.88	350
1-in. heavy-duty drill	9.0	0.99	300
8-in. circular saw	9.0	0.99	4,000 to 5,000
12-in. circular saw	15.0	1.65	3,000 to 4,000
24-in. chain saw	25.0	2.75	1,000 (f.p.m.)
1-in. driver for ⅝-in. lag screw	12.0	1.50	90

Right.—A Type of Power Unit That Can Be Rolled Along on One Rail. Below.—A Power Unit That Can Be Carried Easily By Two Men



Uses Mirrors to Detect Failed Rails

EXPERIENCED trackmen know that it is not uncommon for rails to fail by reason of horizontal fractures at the junction of the head and web, which, if the rail is allowed to remain in the track, eventually extend up through the head until a section breaks out.

In its early stages, this fracture, which may be relatively short and difficult to identify, is known as a fillet crack, because of its position in or at the base of the fillet joining the head to the web of the rail, and because it originates as a minute crack of limited length. As it progresses and becomes more obvious, it is sometimes spoken of as a head-web separation. Because of its location directly beneath the head of the rail, it is hidden from casual observation as well as from any inspection that is not made specifically to bring it into view.

Obviously, it is an exceedingly burdensome task for an inspector to get down low enough to inspect by direct vision the area immediately under the head of every rail in the track. It is so burdensome, in fact, that the inspection is never made in this manner. Yet this form of failure represents a real hazard and occurs too commonly to be ignored, particularly in the lighter rail, some sections of which appear to be more afflicted with this type of failure than others.

Tries Inspection Device

Recognizing the potential hazard of this defect, the Missouri Pacific experimented with the Sands rail inspector, which is manufactured by the Magnetic Signal Company, Los Angeles, Cal. The results were so satisfactory that this device is now being used regularly to inspect all main-track rail lighter than 112 lb. This device consists of a frame mounted on double-flanged wheels that run on top of the rail. It holds a mirror that is set at such an angle that it reflects the fillet and adjacent area under the head of the rail, so that it becomes visible to the operator as he walks upright on the opposite side of the rail.

Either the foreman or dependable members of the regular section forces make the inspection, operating one mirror on each rail. The observation is always made on the gage side of the rail, since the fillet cracks invariably originate on this side and eventually work through the web or fillet to the opposite side, after which they extend longitudinally along the rail. However, on the River district a freight line extending between Jefferson City, Mo., and Kansas City, on which an unusual number of failures of this type have occurred, two full-time inspectors are employed and the foremen are relieved of the duty of making the inspections. An experienced man can make the inspection at the rate of about one mile of rail an hour. He cannot do a dependable job if he moves at a faster rate, and he may be slowed down somewhat where it becomes difficult to determine whether cracks exist. The mirrors are moved continuously over each section, at the end of which they are delivered to the section next adjacent.

Normally, in its early stages, the presence of this defect is disclosed by a characteristic rust streak along the fillet under the head. When an indication of this defect is discovered, the section men put chalk marks on the rails that contain them. They also record the mile-post location and give this information to a special rail inspector who has been assigned to follow up the work of the section gangs, to make a more detailed inspection of the afflicted rails and to determine whether they should be allowed to remain in the track or be removed.

When the inspector makes his inspection, he cleans the surface around the rust streak thoroughly, using gasoline and a wire brush to remove oil, dirt and rust. After the cleaning is completed, the rail is examined, this time with a magnifying mirror. If the defect is not visible after the cleaning, as is often the case, it is not assumed that an error has been made, for many of these cracks in their early stages are almost, if not wholly, invisible with any equipment that is practical for regular use in the field. On the contrary, the suspicious rail is painted with white paint for the full length of the original rust streak that caused the report to be made.

Fortunately, this defect grows rather slowly, particularly during its early stages and until the crack has broken through to the opposite surface of the web or fillet. This makes it unnecessary to take emergency action where there is any doubt about the presence of such a defect. Accordingly, the paint is allowed to dry for several weeks, after which the rail is rechecked. If there is a head-web separation, or even the beginning of one, the rust streak will then show up through the paint. If the rust streak is not visible through the paint at the time of the check inspection, the rail is marked O.K. by the inspector and is allowed to remain in the track. If the streak is visible through the paint, the rail is removed at once.

It is believed that those rust streaks on rails, which are noted by the section forces, but which are later found to have no connection with fillet cracks, are the result of creeping metal, probably because the loading point on the rail head has been changed. This explanation is suggested because this condition occurs most frequently in released rail that was reversed when it was relaid. Occasionally, the section forces, when making the inspection with the mirrors, find a rail in which a fillet crack is clearly visible. Such rails are removed immediately.

How the Crack Looks

Ordinarily, when a crack that exists is not readily visible before the surface is cleaned, the rust streak will be dark red; in fact, quite noticeably so. On cleaning, the crack can usually be seen or, if not readily visible, it can be found by means of a thin feeler blade.

Before the present systematic method of inspection was established, the whole matter was given thorough study. It was desired to learn how one can determine which rails are, and which are not, afflicted with fillet cracks, especially while they are in the early stages of development. As a part of this study, a number of rails that showed rust streaks were cut and broken, and then examined critically and in detail. In this way the characteristic surface indications of the actual defect were determined.

Before a special rail inspector was employed to follow up and check the indications discovered by the section forces, all of the rails having rust streaks that were discovered during their inspections were removed from main tracks because it was not considered to be in the interest of safety or otherwise to be good policy to allow rails that were under suspicion to remain in such tracks. Since the special inspector was assigned to watch the rails that have, or are suspected of having, this type of defect, the percentage of rails found to be actually defective is approximately 41 per

cent of those reported as a result of the original inspection and examined by the special inspector. Today, it is estimated that not more than five per cent of the rails examined and removed are sound. As an example, on one district that handles a relatively heavy traffic, the special rail inspector made minute examinations of 1,018 rails that had been marked and reported by the section forces during a period of five months. Of these 416 were determined to be defective and were removed from the track.

Normally, inspection by means of the mirrors is made on 90-lb. RA rail at intervals of 90 days following the operation of the detector car. However, on certain sections of track where an abnormal number of fillet cracks and head-web separations have been found repeatedly, inspections are being made at 30-day intervals.

Rule 383

When an inspector has determined that a rail is defective, it is marked in accordance with Rule 383 of the maintenance of way department and, if considered necessary, is given flag protection until it has been removed. This rule reads as follows.

"Removal and Disposition of Defective Rails Found by Rail Flaw Detector Car.—Defective rails located by a detector car must be protected immediately after the passage of the car, even though the defect is not visible on the surface of the rail. If a transverse fissure or a compound fissure is indicated, no train must be permitted to pass at a speed in excess of 10 miles per hour until the rail has been replaced. If other defects are indicated, the foreman must decide at what speed trains may be permitted to pass.

"Rails, located by the detector car, that have transverse or compound fissures or other defects that make them unfit for use in track shall be marked with a wide stripe of red paint along the web and base each side of the point of defect. Such rails shall be removed promptly from the track, cut into pieces not more than eight feet long, and disposed of as scrap.

"Other defective rails shall be painted with a wide yellow stripe along the web and base, and in addition, shall have a deep 'X' cut with a track chisel in the top of the ball of the rail about eight inches from each end. Rails so marked must never be used in the main track again but may be inserted in side tracks (but not in sidings except where authorized by the division engineer) back of the clearance point.

"The roadmaster must follow up immediately and know that the provisions of this rule have been met and that reports, on Form MW-20 are made promptly."

Following each inspection, the rail inspector makes a joint report of his findings to the section foreman and the roadmaster. The roadmaster compares the report on Form MW-20 with these reports to insure that all defective rails have been removed. As might be expected, quite often in the operation of the mirrors, other defects are found, some of them also necessitating the removal of the rails.

Pumping Equipment Shows Improvements

(Continued from page 365)

The advantages of this unit are the elimination of the customary long shaft, oil tube, bearings and spiders, and the reduction of friction and subsequent power losses that normally develop with longer shafting.

Other Improvements

In turbine pumps the head developed per stage has been increased to such an extent that a pump of a given size and capacity today will require fewer stages to pump against a given total dynamic head than a pump designed ten years ago. Other improvements include the use of special alloys for impellers; the development of new processes of casting impellers, bowls and other working parts to provide harder metal of more uniform textures; and lining the bowl castings with porcelain to produce smooth surfaces and reduce friction losses—all of which are reflected in the wearing qualities of the bowl assemblies and over-all efficiencies of the pumps.

Most deep-well turbine pumps are electrically-operated, which leaves them useless in the event of power or motor failures. Special driving heads are now available for turbine pumps, which utilize an electric motor as the normal means of operation in combination with a Diesel or gasoline engine as the driving element for emergency use in the event of a power failure or the breakdown of the electric motor.

The improvements in turbine pumps may be summarized as follows: (1) Increased efficiencies, (2) a tendency toward higher speeds, (3) greater capacities, (4) higher total heads, (5) deeper pump settings, (6) fewer stages required, (7) better quality metal in working parts, (8) water-lubricated pumps, (9) submersible pumps, and (10) combination drives.

The four primary types of automatic controls for pumping equipment include (1) float, (2) flow, (3) time, and (4) pressure devices. The float switch is the original automatic control, and is still considered the most reliable under most operating conditions. However, it cannot be considered dependable for use during freezing weather in tanks where ice develops. Many types of flow switches are available. A number of them are equipped with complicated contactors which are a continuous source of trouble; dependable operation demands a simple contact which will not fail under repeated use. Flow switches, which are located in pipe lines, are actuated by the movement of the liquid in a given direction.

Time switches include two types, (1) those that are set to operate at a designated hour, like an alarm clock, and (2) those whose operation is dependent on a definite time lapse after certain operations take place. The first of these is useful at remote pumping stations where it is desired to have pumps operate for a predetermined time interval to coincide with train movements, or where well capacities are limited and it is necessary to operate pumping equipment for only short periods of time. Still another use is for confining pump operations to "off peak" periods when cheaper power rates are in effect.

The second type of time control is particularly adaptable for controlling pumping plants with long discharge lines subject to water hammer, or surges in the line, to prevent successive starting and stopping of the pumping units. As a time-delay device for use with deep-well turbine pumps, it can be set to prevent the motor starting, once it has been stopped, until all the "back spin" is out of the pump shafting.

The pressure-type control is probably the most flexible and the most widely used. It incorporates the use of mercury contact switches which prevent arcing, a decided advantage resulting in a longer life of dependable service. Surges in pipe lines actuate the mercury switches, causing the pumps to start and stop repeatedly until the surges subside, unless the proper time delay control is incorporated as an integral part of the pressure control.

The recent developments of major importance that concern control equipment are not so much improvements in the devices themselves, as in the manner of their use. By utilizing them properly, either singly or in combination, an unlimited number of controls can be produced.

What's the ANSWER?

Double-Shifting Work Equipment

To what extent is it practicable to double-shift power machines engaged in maintenance of way work? Does the type of machine or the character of the work make any difference? What are the advantages? The disadvantages?

Is Not Practical

By J. R. DERRICK
Manager Roadway Maintenance, Norfolk & Western, Roanoke, Va.

It is desirable to double-shift roadway machines to restore traffic in emergencies, but for general maintenance, I do not believe that it is practical to do so, mainly because there are not enough daylight hours. Only during the month of June, when the days are the longest, will it be possible to work two eight-hour shifts during daylight. Even during June, under present war time, it would be necessary for the forces to start work at 5 a.m. and continue until 9 p.m. if they are to work two shifts. If this were done, the light would be poor at both starting and quitting time.

To double-shift machines at other times, it would be necessary to provide artificial light and to work under artificial light would increase the hazards to the forces and impair their efficiency. Obviously, off-track machines can be worked double-shift with greater safety and effectiveness than on-track machines, but, on the whole, I do not believe that it is practical to double-shift roadway machines for regular maintenance work.

Seldom Possible

By F. H. MCKENNEY
District Engineer Maintenance, Chicago, Burlington & Quincy, Omaha, Neb.

It is seldom possible for maintenance gangs to make use of roadway machines outside of the regular hours worked by them. On the other hand, there is no good reason why machines that are worked independently, such as draglines, bulldozers and other off-track machines engaged in ditching, bank widening and other similar work, cannot be double-shifted.

Because of the present shortage of work equipment, it is generally desirable to get the longest and most effective use possible from the machines that are available. To do this they should be worked as many hours per day as is practicable. In some cases this will mean double-shifting and in others the working of two to four hours overtime. This will be governed, however, by the kind of work that is being done. If the jobs are short, with frequent moves to other points, it will probably be better to work overtime than to attempt two shifts, because of the amount of productive time that is lost in moving. On jobs that will be continued longer without a move, the double-shift is justifiable. In ballast pits and in handling storage coal it is often desirable to work two ten-hour shifts rather than three eight-hour shifts, since this allows some time for maintenance work on the machines.

Many old machines have been impressed into service to make up for depleted forces, and the double-shifting of these machines is impracticable.

Send your answers to any of the questions to the What's the Answer Editor. He will welcome also any questions you wish to have discussed.

To Be Answered in July

1. In what ways is the service life of dry cells shortened through misuse? How should they be handled?

2. What effects do the present restrictions on the use of linseed oil have on the quality of paints? On their performance? On their service life?

3. To what extent is it desirable to undertake track drainage and roadbed stabilization work under present conditions? What are the advantages? The disadvantages?

4. What ways and to what extent do the density and importance of today's traffic give emphasis to the use of off-track equipment in bridge maintenance? What equipment? What are the advantages? The disadvantages?

5. Are there any advantages in expanding weed-destruction programs under present conditions? Any disadvantages? Why?

6. What measures should be taken to insure the return of empty oil and chemical drums? Why? How should they be prepared? How handled?

7. Is there any objection to cropping rail released from tangents and relaying it on curves of 4 deg. or sharper? Why? Does the age of the rail, the density of traffic or the speed of trains make any difference?

8. In what ways can nails be conserved? Are there any disadvantages?

Where an operator is assigned permanently to a machine he usually takes a personal interest in keeping it up and, having learned its weak points, will favor it and keep it in operation with the minimum of repairs. If such machines are double-crewed, each operator may omit making repairs during his shift, with the result that a breakdown occurs and both the machine and the gang are tied up or delayed seriously. I have found

that the older off-track machines can be operated more successfully by a single assigned operator than by two or more crews. It is becoming increasingly difficult to obtain operators and it seems that on many jobs it will be impossible to provide double crews, so that even though it may be desirable to do so, it cannot be done because we lack the man-power.

Under existing conditions, work equipment should be operated in such a way as to obtain maximum production with the man-power available. Whether this can or should be done with double shifts or by working longer hours must be determined by the maintenance officers in charge, after considering all factors connected with the work to be done.

Substitute Culvert Materials

To reduce the consumption of critical materials, what substitutes can be employed for cast-iron and reinforced-concrete pipe in culverts? To what extent? What are the advantages? The disadvantages?

Suggests Creosoted Wood

By R. P. Hart

Bridge Engineer, Missouri Pacific, St. Louis, Mo.

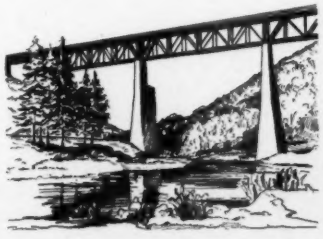
Under present conditions it is sometimes difficult to say just what are critical materials. Although metals have generally been considered to be more critical than some other materials, it developed a few months ago that structural timber had also become a critical material, particularly the stress grades. It is still possible to obtain the lower grades, however, which can be used in the construction of wood box culverts. We can, therefore, still consider the creosoted-wood box culvert as a substitute for cast-iron and reinforced-concrete pipe.

Triple-strength vitrified-clay pipe in the smaller sizes has been found to be a satisfactory substitute for cast-iron and reinforced-concrete pipe for culverts. At this time triple-strength vitrified-clay pipe cannot be obtained in sizes longer than 30 in. and frequently 24 in. is the limit. A comparison of the load-carrying capacity shows that if manufactured in accordance with recommended specifications, the triple-strength vitrified pipe is comparable to the reinforced-concrete pipe. The creosoted-wood box can be designed to carry such railway loading as the user may require and, when the timber is creosoted, a service life of 30 or more years can be expected, provided the timbers are fastened together adequately with wrought-iron or galvanized steel hardware, so that failure will not occur by reason of corrosion of the fastenings.

In general, the extent to which creosoted-wood box culverts may be substituted for cast-iron or reinforced-concrete pipe culverts is unlimited, the exceptions being those cases where local conditions make it undesirable to use creosoted wood because of the fire hazard. Such conditions exist around oil refineries and in heavily-wooded districts where forest fires are common. A particular advantage of using wood-box culverts instead of jointed-pipe culverts, is that the structure can be tied together throughout its entire length by lapping the various pieces of timber and eliminate any separation of joints, such as often occurs in jointed pipe culverts of cast iron and reinforced concrete. Another advantage of the wood box is that the timber can be preframed, creosoted, and sent to the site for assembling in pieces of such weights that they can be handled without assistance from power equipment.

There are no disadvantages in using creosoted-wood box culverts except the possible fire hazard and the fact that decay can be expected unless the timbers are treated thoroughly after being framed. The cost of a wood-box culvert is about the same as that of corrugated metal pipe and somewhat cheaper than either cast-iron or reinforced-concrete pipe. Triple-strength clay pipe is somewhat cheaper than creosoted timber, but is not obtainable in sizes that are frequently needed to provide an adequate waterway. The clay pipe is also subject to some loss from breakage in handling.

It appears that for the duration, creosoted-wood box culverts will provide a satisfactory substitute for metal and concrete pipe culverts. So far, it also appears that there is an adequate supply of the grades of timber which will normally be used in the construction of such boxes. Particular attention should be given to the matter of fastenings for the wood boxes so that failures will not occur by reason of the failure of the fastenings. Although general standards can be followed in the construction of wood-box culverts, it is desirable that the material for each culvert be framed according to a detailed plan before it is creosoted, so that there will be less opportunity for decay to set in around the ends of the individual pieces or the bolt holes which are necessary for assembling the structure in the field.



There Are Five Types

By General Inspector of Bridges

In the order of their consumption of critical materials, pipe culverts may be classified under five types, these being (1) cast iron, (2) corrugated iron, (3) reinforced concrete, (4) creosoted wood, and (5) vitrified clay pipe. The latter, being composed entirely of clay with a salt glaze, requires no critical material for its manufacture, unless the fuel used in burning it be so classified. To this list should be added the square box type of culvert constructed of creosoted timbers and certain proprietary box culverts constructed of laminated creosoted-wood sections to form openings of rectangular or octagonal cross sections.

Any one of these three culverts will answer the requirements equally well under ordinary conditions, although some special conditions may require special designs. For example, where a culvert is required to carry waste water that has a high acid content or other corrosive agents destructive to metal or concrete, it may be necessary to devise special or heavy coatings to resist their action. Mine wastes, sewage and wastes from oil wells, oil refineries and other industries often contain free sulphuric acid, while salt and other corrosive substances are among the waste products that must be considered in this connection. Free sulphuric acid will attack both concrete and metal pipes, while salt is more severe on metals. Aside from their greater resistance to corrosion, wooden pipes and box culverts, and vitrified clay pipe appear to be logical substitutes for cast iron and reinforced concrete from the standpoint of saving critical materials.

Wood culverts require the minimum critical materials and vitrified

pipe none at all. Both are limited as to size, however, for the wooden pipe is restricted to 30 in. and the vitrified clay pipe to 36 in. On the other hand, wood-box culverts are limited in size only by arbitrary limits placed on length of spans, depth of cover or other conditions calling for small bridges or concrete arches. Small culverts under roadways and for ordinary sewers can be of vitrified pipe; vitrified pipe under track should be extra strong and should conform to A.R.E.A. specifications.

Motor-Car Spark Plugs

What is the average life of a motor-car spark plug? How long should it last? What can be done to prolong its life? How can it be reconditioned?

Average Only 106 Days

By C. R. Knowles
Superintendent Water Service (Retired)
Illinois Central, Chicago

Several years ago, a check was made by a mid-western road on the purchase of spark plugs for motor cars, over a period of four years. At that time the road had 1,600 motor cars in service, about half of which were equipped with two-cylinder engines, involving a total use of 2,400 spark plugs for all motor cars. During the four-year period a total of 33,020 spark plugs were purchased, which represented an average life of 106 days for the 2,400 plugs in service. However, the actual life of individual spark plugs varied between wide limits, ranging from only a few days to as long as 15 months.

Assuming that the average daily mileage of the 2,400 motor cars did not exceed 50 miles, a liberal figure, a new plug was required approximately every 5,000 miles. A spark plug should be good for a minimum of 10,000 miles, so that if these figures apply to all of the railways, the proper use and care of spark plugs will double their present life. It is estimated that there are 61,500 motor cars in active service. It is apparent, therefore, that large savings can be made in both money and material by taking measures that will assure maximum life for spark plugs.

If a few pertinent rules relating to their care and operation are observed, the life of spark plugs can be prolonged. The spark gap between electrodes should not be less than 0.03 in. or more than 0.04 in. for battery ignition, the wider gap probably being the most satisfactory for one and two-cylinder engines. A worn dime ranges in thickness from 0.036 to 0.040 in. so that in the absence of a spark-plug gage, the dime can be used to measure the spark gap.

Magneto manufacturers recommend a spark gap of 0.03 for magneto-equipped engines. Lower cylinder compressions permit a slightly wider gap and a longer spark, which is advantageous with fuel mixtures that are a little too lean or a little too rich. An improper spark gap is the cause of many engine failures and not infrequently spark plugs are scrapped, although they could be put into good shape merely by adjusting the spark gap. The spark gap is of particular importance when a poor grade of gasoline is being used during cold weather.

Spark plugs are often destroyed by breaking the insulators, which are porcelain or other similar material. Not infrequently this happens in bending the center electrode to set the spark gap. The shell or outside electrode should always be moved in setting the gap. Other causes of broken insulators include too lean a fuel mixture, which generates excessive heat; the sticking, or failure of valves in four-cycle engines to seat; or the use of the wrong kind of a spark plug.

Spark plugs will become foul as a result of a too-rich mixture of fuel, from an excess of lubricating oil or when for other reasons a coating of soot or other carbon deposits on the insulator creates a short circuit to the shell instead of allowing the spark to jump from point to point of the electrodes. The fouling of spark plugs is usually indicated by the engine missing or by failure of the engine to start when it is cranked. A spark plug should be cleaned with a cloth or bunch of waste, after it has been removed from the cylinder. Hard deposits should be scraped from the insulator with a knife; sandpaper or emery cloth should never be used on the insulator as it may destroy the glaze, thus permitting it to absorb oil and dirt and cause a short circuit.

If the plugs are taken apart for cleaning, care should be observed in reassembling them, screwing the parts together tightly so that the insulator is seated firmly on the gasket. Otherwise, loss of compression through the shell of the plug probably will produce such intense heat that the insulator may break and the electrodes and ground wires burn off. Pre-ignition may also occur because of this compression leakage. Loss of compression can sometimes be avoided and the life of the plugs be prolonged by replacing old gaskets with new ones. There is little danger of cracking the insulators by screwing them tightly onto the gasket, provided wrenches of the correct size are employed and are not allowed to slip and strike the insulators.

New spark plugs should be handled carefully to avoid damage to insulation and electrodes. All released spark plugs should be saved and turned in to the motor-car shop for examination and possible reclamation. Many discarded plugs can be repaired at small cost, thus saving valuable material. As an example, in one case, 362 discarded spark plugs that were considered by the users to be completely unfit for further use, were collected and sent to the repair shop for examination. As a result of this test, 63 or 17 per cent of the plugs were found to require cleaning only; 252, or 70 per cent, were repaired and returned to service; while only 47, or 13 per cent, were scrapped as unfit for further service. Since this was considered a typical case, it is evident that many spark plugs are being scrapped that might be reclaimed.

Too Commonplace

By Roadmaster

Spark plugs have been so plentiful, so inexpensive by comparison with other replacement parts, so easily obtained and so easily replaced, that they have come to be looked upon as commonplace, for which reason little attention is paid to them until the engine misses or will not start. When this happens, it is not uncommon for the foreman or motor-car operator to substitute a new spark plug, laying the old one away without examining it, perhaps to send it in as scrap. An examination of almost any section tool house will disclose one or more of these discarded spark plugs, many of which need only cleaning to fit them for further service.

Although the cost of the individual spark plug may be of little consequence, the aggregate cost of the total consumption for a year represents a sizeable amount, a large part of which can be charged to waste through carelessness or neglect. Today, when we cannot afford to waste anything, especially metals, neglect or

carelessness in the care of spark plugs is little short of criminal. Several years ago, after checking our consumption of spark plugs and calculating their average life, I discussed spark-plug service with garage men and truckers. I became convinced that our service life was much too low, and I asked our division repair man to give the foremen a course of training in the care of spark plugs. We got no miraculous results; in fact, we got no results whatever at first. The first two trips were scheduled and definite instructions were given. After that, every time the repair man was with a gang he examined the spark plugs, commending the foreman if they were in good shape and pointing out his error if they were dirty, damaged or otherwise unsatisfactory. Through this arrangement, coupled with some pressure from me, we gradually extended the average service life to a little more than twice its former period.

Saving Broken Rails

In view of the present shortage of replacement rails, is it practical to apply joint bars to broken rails for an indefinite period? What types of breaks?

It May Be

By F. J. Bishop
Engineer Maintenance of Way, Toledo Terminal, Toledo, Ohio

It may be both practical and economical in many cases to apply joint bars to broken rails for an indefinite period. In a busy terminal a broken rail on any important running track might cause considerable train delays if steps are not taken at once to make it safe for traffic. The most practical and the quickest method of repair must be resorted to and the application of joint bars usually meets these requirements. The heavier rails now in service in main and other important tracks require more men to replace them quickly than the former lighter sections. Because of the present acute labor shortage, it is frequently impossible to assemble sufficient men to replace a rail without serious delays to traffic. On the other hand, joint bars can be applied quickly to restore the track to service, with a very small force.

Where joint bars are applied to broken rails, they can remain in the track indefinitely under certain conditions with considerable savings in both replacement rail and the labor necessary to change out the rail. Where joint bars are so applied, the rail should be drilled and at least two bolts should be installed. On main tracks or on heavy-traffic running tracks, the joint bars should be fully bolted if the rail is to remain in service for any considerable time. Such joints in track-circuit territory should be bonded promptly to prevent failure of the track circuit.

If the break is a square one, such as usually occurs with a transverse fissure, a good joint can be made by applying joint bars and full bolting the rail, with a considerable saving in replacement rails and labor. On the other hand, it has been found to be impracticable to allow joint bars to remain on broken rails indefinitely if such application results in very short pieces of rail or if the rail is generally weak and otherwise defective or is considered unsafe for the character of the traffic that is being handled.

Only Temporarily

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

Every failed rail to which a set of joint bars has been applied, with the idea of keeping it in service for the maximum period possible, merely adds to the cost of maintaining the track. Even where new rails are laid some of them must be cut for closure at crossings, at turnouts and often at highway crossings, or to permit the installation of insulated joints. After these short rails have been in service for some time they begin to be afflicted with low or battered joints, particularly if they are in high-speed track, more than other rails of standard length in the same track. Where the rail is already worn the trouble is intensified.

If the break is of such a nature that this can be done, the quickest way to get traffic to moving again is to apply joint bars, drilling the rail for bolts. Unless the rail is obviously defective in other ways, no harm will be done by leaving it in the track for a day or two, even if it is caused by a transverse fissure, but this type of repair should not be considered permanent, and the rail should be replaced as soon as this can be done conveniently. The fact should never be lost sight of that if a rail contains one transverse fissure, it may contain others and may fail in the same way at any time.

On the other hand, if the break is a square one and there is no evidence of a transverse fissure, the rail can be left in the track permanently, so far as safety is concerned, provided the shorter section is of equal or greater length than the minimum permitted for main track service. Such rails will batter easily, however, and get out of line and will cause poor riding. I can see no purpose in trying to keep a broken rail in a main track. It would be better to sort out a few rails when making renewals and hold them at some central point for replacement purposes, and then transfer the broken rail to a siding or a side track where the traffic is light and the speed slow.

One Defect May Mean More

By George Stafford
Section Foreman, Canadian National, Redland, Alta.

In considering this question one should not overlook the fact that the majority of rails that break in service do so because of some internal defect and that if the rail contains one hidden defect there may be more, this being particularly true of transverse and compound fissures. Obviously, it is not possible to repair some forms of broken rail by applying joint bars, such as split heads, fillet cracks, split webs, etc., since they are progressive and may soon extend beyond the limits of the joint.

A serious objection to the practice is the effect it will have on the riding qualities of the track. In unsignaled territory a number of trains might pass over the broken rail before it is discovered, in which event a snug fit can rarely be made when the bars are applied. Again the insertion of a rail less than 15 ft. long is open to criticism, but in the majority of rails that break one section is less than 15 ft. Taking all factors into consideration, it is believed that such a practice is ill-advised from the standpoints of safety, economy and riding qualities of the track. What has been said

refers to high-speed main tracks. For sidings, running tracks in yards and elsewhere where speeds are low, many broken rails can be repaired in the manner indicated and thus be continued in service indefinitely with little hazard and in most cases with no detriment to the service of the track.

Supervising Outfit Cars Better

To what extent can foremen conserve materials through closer supervision of outfit tool and supply cars?

Must Be Interested

By L. G. Byrd
Supervisor Bridges and Buildings, Missouri Pacific, Poplar Bluff, Mo.

To conserve material, tools and supplies, the supervising officer must first of all be interested in every phase of his work and particularly in this subject. In the second place, he must educate the foreman to care for and conserve the materials and supplies in their charge.

Tools should be placed carefully in tool boxes, under lock and key, at the close of each day. Care should be exercised to avoid abuse of edged tools and the overloading of blocks, lines, chains and jacks. If this is done, tools will last months longer. They should also be oiled when this is needed. Other supplies, such as oil, gasoline, fusees, torpedoes and waste should be kept in separate compartments, also under lock and key. No item of material or supplies used by a gang is unimportant, and the replacement of most of them is more difficult today than ever before. For this reason, foremen should understand that it is their responsibility to conserve the material and give closer supervision to supplies than in the past.

Only One Answer

By General Bridge Inspector

Long experience as a foreman and later as a supervisor has taught me that there is only one answer to this question, and this is good housekeeping. Where tools, equipment, odds and ends of material and scrap are allowed to accumulate in outfit cars they eventually become little more than junk heaps, the only correction for the situation being to have a place for everything and everything in its place.

Tool cars should be exactly what their name implies. Where supply or material cars are provided, they should also be used for only one purpose, that is the housing of usable material. Scrap and other material unfit for use should be kept segregated from serviceable material. It is a good practice to gather up scrap and unserviceable material every day and ship it as soon as enough has accumulated to warrant the shipment. The war has placed the handling of scrap on an equal footing with other materials from the standpoint of prompt handling. It is sometimes difficult to differentiate between what is usable and what is scrap, but if the known scrap and the clearly usable material are separated it will be much easier to decide what to do with the remaining questionable material.

Shortages of badly needed materials growing out of the war have seriously hampered maintenance-of-way work. At the same time it is a tribute to the maintenance-of-way forces that so much has been accomplished with so little to do it with. The present situation has completely dispelled the old idea that all material used must be new and many of us have learned to utilize many items that have been reclaimed from the so-called scrap pile. Horse sense must be applied to the reclaiming of materials, however, for it is possible to carry this matter too far. On the other hand, the danger lies chiefly in neglecting to reclaim usable material, rather than in overdoing reclamation. The surest way to avoid the necessity for reclaiming materials from the scrap pile is to prevent their discard before they have completed their useful life and the best way to do this is to establish habits of good housekeeping.

Saving Critical Materials

What non-critical materials can be substituted for critical materials in the maintenance of shops and enginehouses? What are the advantages? The disadvantages?

Several Possibilities

By General Inspector of Buildings

Obviously, the replacement in kind of steel sash is no longer practical as a routine matter. For this reason, when it becomes necessary to renew a window of this type one should consider carefully the relative merits of wood sash and glass blocks. In doing so, it should be borne in mind that while wood frames and sash are entirely feasible and that they have been used in engine houses with complete satisfaction for many years, the large window openings in many shop buildings will require rather large strong mullions and considerably heavier muntins and rails than the corresponding steel members, thus reducing the amount of natural light. If wood sash is used, it should be given preservative treatment to insure longer life, while, if there is a fire hazard involved, the sash and frame should also be fireproofed.

In most cases it will also be feasible to use glass blocks, which have been found to be well adapted for use in both enginehouses and shops. They are not affected by gases or other corrosive agents and pass a satisfactory amount of light. One should be careful, however, to select a type that will take and hold a mortar bond; otherwise they may give no end of trouble. Where ventilation through the windows is desired, provision can be made for the necessary openings and the insertion of pivoted wood sash or reclaimed steel sash.

Where sections of the floors in shops or enginehouses must be renewed, it may be possible to use plain concrete, placing it on a well compacted fill, but making it of sufficient thickness to avoid the use of reinforcing bars. Hard-burned brick on a plain concrete base may also be used to advantage to avoid the use of metal reinforcing. In this connection, it is entirely feasible to substitute wood or concrete manhole covers for the cast-iron covers now in service around most shops and enginehouses.

It has been suggested that wood, some form of fibreboard or plywood be employed for lockers where renewals or additions become necessary. There is some fire hazard involved in the use of any form of wood for this purpose, so that, if used, it should be fireproofed. We have not yet been called upon to make a decision in this matter, but as I view it at present, I would prefer some form of asbestos or a non-inflammable composition to

wood for lockers, especially where greasy or oily clothing is being stored. Certainly I would not advocate the installation of metal lockers under present conditions.

Suggests Substitutes

By Supervisor of Bridges and Buildings

To some extent we have ceased to consider the use of critical materials in the maintenance of buildings, and this applies to many structures other than enginehouses and shops. The reason that we generally, and preferably, advance for this is that we desire to avoid in every way any chance of hampering the war effort. This reason is advanced sincerely and honestly; yet there is another important and, in some cases, immediate reason that has as much to do with our decision as the first one. This is the difficulty and delay involved in getting the critical materials which we have learned to prefer. If we have a job that must be done without delay, our only course is usually to utilize such substitute materials as are available, without reference to our preferences. Through this form of necessity we are learning to follow the same course for those jobs where we have more time to consider what we shall do.

Downspouts provide an example. Heretofore, we have used corrugated copper on stations and six to eight-inch wrought pipe on shops and enginehouses. We have recently found it necessary to renew some downspouts on both types of buildings, and have done so with wood. We do not like their looks quite so well as we do those of metal, and we expect to replace them when the emergency is over, but the appearance is much better than we expected.

We have renewed several smoke jacks and have installed several others in enginehouse extensions. In these cases we framed the jacks of wood and sent them to the treating plant for fireproofing. We do not know yet how this will work out, but we thought it worth while to take such precautions as were available.

Recently, we had to install a hot-water tank in a wash room we were constructing. None was available and we were unable to obtain one on the market. After a search we found a compressed-air reservoir that could be discontinued and we completed the installation with it. Although it had to be taken out of active service, we were able to get it without much difficulty because the wash room was a facility that the mechanical department greatly desired.

Many of the things we are doing today for the express purpose of avoiding the use of critical materials are things that I would be reluctant to do in normal times. They can be done as temporary expedients, however, to tide us over an emergency situation without seriously impairing the property or lowering its serviceability for the moment. On the other hand, many of them are the reverse of economical, for while the initial cost is almost insignificant in some cases, the eventual cost will be relatively high, and the bill may have to be paid at a time when we can ill afford to do so.

Eliminating Slow Orders

In what ways can slow orders be eliminated and delays to trains avoided when doing out-of-face surfacing? What precautions are necessary?

Many Factors Involved

By P. O. Ferris
Chief Engineer, Delaware & Hudson, Albany, N.Y.

Slow orders can be eliminated, or at least considerably reduced, if the following precautions are taken:

Safety should always be considered as of first importance and any instructions issued to the foreman should stress this fact. Trains should be stopped or slowed in any cases where there is any question about their safe passage at any speed.

Before any work is undertaken, the gang should be well organized. Careful judgment of what can actually be done should be exercised by the foreman in charge. No work should be undertaken that can not be completed for the safe passage of a train at regular speed, before scheduled trains are due, and a margin of at least 10 minutes should be allowed. The foreman should have complete knowledge of the time of arrival of all trains. If necessary, an operator with a portable telephone should accompany the gang.

On some days traffic is light and, with co-operation from the dispatcher on such days, more productive hours can be arranged without interfering with traffic. Because of traffic conditions, it may be possible to divert traffic to other tracks by installing temporary crossovers.

When work is to be carried out without interference with trains, long run-offs should be made to avoid the necessity for slowing trains. Men should be posted as far ahead of the work as practicable to warn of the approach of trains. The foreman should be in position to acknowledge such warnings and to warn the engineman ahead so that he will not have to slow down.

Under present traffic conditions it is important that every cause of delay to trains be avoided. Obviously, it is difficult to do this where trains are operated at short intervals, but the importance of individual trains should be considered. Important as it is to keep traffic moving normally, safety is of still greater importance, and the foreman must be impressed with its importance in carrying out his duties.

Cannot Avoid All Delays

By T. M. Pittman
Division Engineer, Illinois Central, Waterloo, Iowa

It is impossible to avoid delays to every train when track is being surfaced out of face, without increasing the cost of the work. The problem then is to strike a happy medium between the additional cost of the work and the cost of the train delays. The situation varies between such wide limits on different parts of a line and with the different conditions of surfacing that only a general statement concerning the possibilities can be given. Each situation will have to be worked out in the light of local conditions and this requires close co-operation between the foreman and the dispatcher.

Safety of trains is the first consideration, and the higher the train speeds, the more the time that will be required to prepare the runoff. If the raise is light, only a little extra time may be needed to prepare it for moderate speeds. If the lift is high, the speed should be slow partly because of less stable track and partly to allow for preparing the runoff without bringing the train to a stop. On multiple tracks it may be possible to divert traffic during certain hours. If this is done, a larger force should be employed to make the best use of the time available and shorten the period of diversion.

Where traffic is mixed, there are some trains that it would be objectionable to delay. If they are

scheduled, the foreman can have his track ready when they arrive and pass them at a considerably higher speed, or even full speed, by use of a hand disc designed for this purpose. A close line-up from the dispatcher will help in all cases. On heavy-traffic lines this will justify the employment of a telegraph operator equipped with a field telephone. When important trains are expected near the beginning or the end of the day or at the noon hour, the work can be adjusted to permit the passage of these trains at full speed. Special attention should be given to heavy trains going up steep grades where substantial delay might cause them to stall or drag for several miles.

After all, the solution of this problem rests with the supervisor and the foreman. They must exercise good judgment in planning and executing the work, and use the disc signal according to the class of train approaching, to the end that a correct balance will be maintained between the cost of the work and delays to trains.

Can Water Hammer Be Avoided?

Where the delivery of water to locomotives must be speeded up, what provision should be made to overcome the hazard of water hammer? What is the alternative?

Demand Still Faster Flow

By J. P. Hanley
Water Service Inspector, Illinois Central, Chicago

This is a pertinent question today, since the large-capacity locomotive tenders now in wide use require a fast rate of flow if they are to be filled without delaying trains. Flow at the rate of 4,000 to 5,000 gal. per min. is desirable if this can be obtained without surging the spout or causing severe water hammer. If the latter occurs, joint leakage, damaged pipe and damage to the water column itself may result.

Water columns now in use are generally provided with (a) spring-operated pressure-release valves; (b) with pistons having differential areas; and (c) with slow-closing devices. The latter checks the last 15 per cent of the closing cycle in a gradual manner that reduces the shock. Some work has been done by the engineering experiment stations at the Universities of Illinois and Wisconsin on the flow of water and on water hammer in water columns at the request of a manufacturer of this equipment.

It is advisable to give increased consideration to the problem at present because the demand for faster flow is greater today than ever and continues to increase. Good maintenance of existing facilities should be insisted on and effort should be made to improve methods and devices where possible. When conducting an investigation it will be desirable to use a recording pressure gage for suitable periods at one or more points on each supply main that is giving trouble from leakage, to study the build-up of pressure at these points.

Places have been found in some mains which are subject to chronic trouble from the effects of water hammer, while the remainder of the main gives little or no trouble from this cause. The gage readings will indicate readily where the pressure bottlenecks are. When found, an additional relief valve should be installed at the point so indicated. This valve may be of smaller size than the main relief valve at the water column.

In new work, abrupt-turn fittings and abrupt changes of grade should be avoided in the supply main, as they create pressure bottlenecks and air traps, both of which result in poor service. In other words, fast water flow requires straight mains of ample size, carefully installed.

Tank Acts as Buffer

By District Engineer

Water hammer is induced by the closing of a valve or other stoppage of the flow in a column of water. If the stoppage occurs suddenly, it will cause high momentary bursting pressures in long lines or if the velocity of flow is high. Oddly, the first three-fourths of a valve closure does not cause any appreciable increase of pressure in a pipe line, but the final one-fourth builds up the pressure rapidly and causes water hammer. Instantaneous closing of a valve will create extreme pressure. The higher the velocity of flow, the longer the pipe line—that is, the longer the moving column of water—or the quicker the closing of the valve, the more severe will be the hydraulic shock.

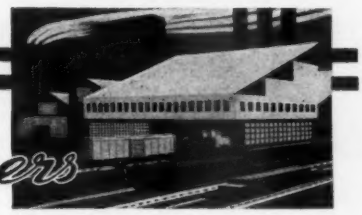
Water column lines are rarely broken by water hammer, because they are generally relatively short and are open to the tank so that the hydraulic shock is largely dissipated in the tank. One has only to observe the action of the water in the tank when the valve in the column is closed, to realize the effect of the water hammer, as it is so violent at times that it will shake the structure. It is true that joints in the pipe line are sometimes blown out or loosened, so that leaks occur, but as a rule, little other damage is done. Service taps off a water-column line should be avoided, for the increase in pressure is specially severe where the pressure wave passes into a smaller pipe with a dead end, and the smaller pipe and fixtures may be damaged severely.

The simplest method of preventing water hammer is through the use of slow-closing valves. To be effective, however, the rate of closure of the valve should be proportional to the length of the line and the velocity of flow. Slow closing valves are not practical on main-line locomotive water columns because of the time consumed in closure. The valve design has been improved in modern water columns, with the view of reducing the hazards of water hammer. Some are so designed that the final clearance of the valve is controlled in such a manner that the shock of closure is somewhat lessened. These improvements have done much to overcome water hammer.

Regardless of the type of valve used, a relief valve should always be provided where long pipe lines are used or where the velocity of flow is high. The openings of relief valves should be given careful consideration, as the valves allow only waves of intensity to pass through them, corresponding to the tension in the valve springs. Air chambers of ample size, placed near valves and at other critical points in long lines will do much to overcome water hammer as they prevent the pressure wave from passing through them. Open standpipes extending above the normal hydraulic gradient offer another means of overcoming the effects of water hammer.

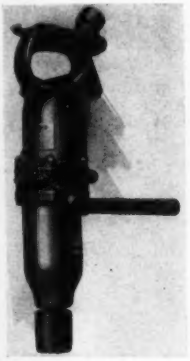
Pipe lines large enough to reduce the velocity of flow should be used in new installations, and this is particularly desirable if the line is a long one. On the other hand, it may be cheaper and more satisfactory to erect an additional tank near the water column, thus reducing the length of the supply line. The difference in the cost of a large line to the water column and of the smaller supply line to the tank may be greater than the cost of erecting the tank, thus effecting a saving in the out-of-pocket cost as well as in the quantities of critical materials required.

PRODUCTS of Manufacturers



New I-R Impact Wrench

A NEW reversible impact wrench, designated as size 514, has been introduced by the Ingersoll-Rand Company, Phillipsburg, N. J., to supersede its size 511. Although it has approximately the same weight, the new unit is said to be about 30 per cent more powerful than the wrench that it replaces. Embodying all the features of the Ingersoll-Rand line of impact wrenches, the new machine is recommended for use in applying and removing nuts and cap screws having a thread size up to ¾ in. Standard equipment for the size 514



The Ingersoll-Rand Size 514 Impact Wrench

wrench includes a No. 48 "dead" handle, a No. 209 chuck for hexagon nuts 1 1/16 in. across the flats, a No. 243 case bolt nut wrench, and a No. 380 oil plug wrench.

LeTourneau-Hyster Unit Designed for Double Duty

R. G. LeTOURNEAU, INC., Peoria, Ill., has developed a Model HN power control unit which, although designed for military use, can be utilized by loggers, contractors and other tractor users who have need for a bulldozer operation plus a power winch. The unit embodies a LeTourneau single-drum power-control unit for bulldozer operation with a Hyster D4 towing winch, making possible the combination installation of a bulldozer and towing winch on the same D4 or R4 Caterpillar tractor.

Both the Hyster winch and the power control unit are standard models combined into one compact unit, and the towing winch and the PCU can be operated independently or together. The drum has a speed of 308

Close-Up of the HN Power Control Unit

ft. per minute on the bare drum, and the winch has a line pull of 15,400 lb., with a line speed of 91 ft. per minute on the bare drum.

What Our Readers Think

More on Safety and Motor Car Accidents

Joliet, Ill.

To The Editor:

I have read with great interest the articles in the What's the Answer section of your April, 1942, issue entitled "Why Have Motor Car Accidents?" and the article of the same title by C. F. Larson in your January, 1943, issue. As a bridge and building foreman who has been interested in safety and accident prevention for many years I wish to add a few observations on this subject. Before discussing safety I might add that I am retiring next June at the age of 65, that in 16 years in charge of a gang, I have had only one lost-time accident which resulted in an old experienced steel worker losing a finger, and I have never witnessed a railway accident in which anyone has been seriously injured.

This is a mechanical age. Man has devised many machines and devices to ease his work or protect himself. Mechanical things themselves operate according to laws of nature and when abused or mis-used eventually fail and cause accidents. The same is true of man; if he abuses himself (by excessive drinking, for example) his failure to think clearly or to react quickly and intelligently in an emergency will also eventually cause an accident. Such man-failures are probably the prime causes of a majority of motor car accidents.

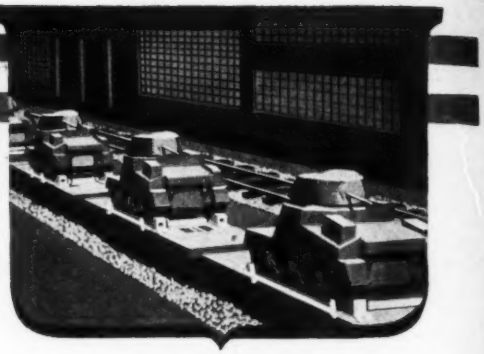
Those of us who have had years of experience in operating motor cars realize that a motor car operator must guard against his involuntary actions as well as voluntary actions. To do this, he must keep himself physically fit and alert. Although he must obtain a line-up, check his watch and have all other information he considers necessary for the movement of his motor car, he must not rely on such safeguards. With very few exceptions in 25 years, I never left or proceeded on a motor car with a clear sense of security. Instead, I was always on guard against the likelihood of interference or the existence of some possible obstruction.

Another fundamental cause of motor car accidents is the modern pressure for speed or more production. Normally a gang foreman is just as anxious as any of his superior officers to get to the job and complete it as soon as possible. He has a motor car, often a push car too, loaded with men, tools and materials and is told to "get there and get it done." Yet when he is using the main line or working on the main line he is entirely upon his own and trains are given the supreme right, so far as track occupancy is concerned.

As long as men are forced to occupy the main track without protection, some accidents will occur, especially if they are constantly being pressed to "hurry up." In spite of the utmost vigilance, I admit that I have had many "close calls," and in answer to the question "Have We Gone Far Enough" I suggest that the property of all departments and the lives of all employees are of equal concern from an accident prevention standpoint and until men operating on or repairing the main track are given train order protection under the direction of the dispatcher, we have *not* gone far enough.

Arthur Hunsley,
Bridge and Building Foreman,
Elgin, Joliet & Eastern.

NEWS of the Month



Railroading in North Africa

Railway maintenance in many parts of North Africa had been allowed to fall below normal standards after the fall of France, according to a recent article in the Railway Gazette (London). The problem of supply after the Allied Forces landed, therefore, was a difficult one, although British and American engineers are reported to have achieved remarkable results in reorganizing the railway systems in battle zones and French overseers, with the help of Arab laborers, carried out routine maintenance in areas further back.

Oil Movement Sets New Record

Rail deliveries of petroleum products into the East-coast area reached a new all-time peak of 933,966 bbl. daily during the week ended April 3. The daily average tank car deliveries were 912,919 bbl. while 21,047 bbl. a day came in drums loaded into box cars. The record compares with the previous high of 856,710 bbl. daily delivered during the week ended September 19, 1942.

On April 14 the record for tank car movement from Norris City, Ill., was the largest from any point in the country, and probably in the world. It was reported that 1,049 tank cars, loaded with 9,693,000 gal. of crude oil were dispatched from that point in one day.

New Maintenance Order Supersedes P-88 and L-229

Preference Rating Order P-142 was issued by the War Production Board on April 5 to become, as of that date, the new medium whereby railroads and other transportation agencies will obtain materials for maintenance, repair and operating supplies. It supersedes orders P-88 and L-229, which were revoked as of April 5, and CMP Regulation No. 5 (which assigned an AA-1 rating as of April 1) insofar as the larger transportation systems are concerned. Under the new operation, the transportation systems covered will list their requirements on Form PD-844 (similar to PD-351 under P-88), quarter by quarter, including controlled materials. These lists will be sent to WPB, which will screen them and then assign preference ratings to the quantities which are justified. If an allotment is considered necessary under CMP, it will be made.

The WPB also may assign specific preference ratings to deliveries of specific materials needed for emergency repairs, upon proper application. The certification MRO-P-142 and serial number must be used both in applying preference ratings and in obtaining controlled materials.

Order Prohibits Changes of Employment

War Manpower Commission regulations effective April 18, which are designed to stop transfers to jobs at higher wages "unless the shift is in the interest of the war program," were drafted to carry out the wage and employment stabilization provisions of President Roosevelt's "hold-the-line" executive order, the WMC pointed out in recent statements.

The regulation is intended to prevent an employee from shifting from work in an essential activity to another where higher wages are paid, if the higher-paid activity is not on the essential list, or if the shift is not subject to and in accord with one of the WMC employment stabilization plans. It does not prevent transfers from activities not on the essential list to those that are, even if an increase in wages is involved, the WMC emphasized, nor does it as yet prevent transfer from one non-essential activity to another.

Capital Expenditures Less in 1942 Than in 1941

Despite a shortage of critical materials and a growing shortage of labor to apply them, capital expenditures for equipment and other improvements to railway property of Class I railroads in 1942 were larger than in any year since 1930, except 1941. Capital expenditures in 1942 totaled $534,897,000, only $8,124,000 below the total for 1941. In 1930 they amounted to $872,608,000.

Capital expenditures for roadway and structures in 1942 totaled $185,523,000 the largest amount, with the exception of 1937, since 1931 and comparing with $175,453,000 in 1941. In 1937 these expenditures totaled $186,916,000. More than half of the sum spent in 1942 went for the improvement of tracks and sidings, indicating the emphasis that was placed on projects to keep the record volume of traffic rolling. Expenditures for yards and sidings, totaled $43,330,000, as compared to $25,374,000 in 1941, while $6,235,000, was spent for additional track, as compared to $3,781,000 in the preceding year. Similarly, capital expenditures for signals, interlockers and automatic train control, including telephone and telegraph lines rose to $16,261,000, as compared to $13,439,000 the year before. The railroads spent $33,100,000, for heavier rail, as compared to $36,108,000 in 1941, a decrease of $3,008,000, reflecting the increasingly tense materials situation. A total of $5,487,000 was spent for additional ballast, nearly the same amount spent for this purpose in 1941, while capital expenditures for bridges, trestles and culverts aggregated $21,471,000, as compared to $19,419,000 in 1941. Capital expenditures for shops and enginehouses amounted to $13,623,000, as compared to $13,920,000 in the preceding year and $10,623,000 was spent for stations, office buildings and other station facilities, as compared to $11,000,000 in 1941. Expenditures for other improvements declined from $46,526,000 in 1941 to $35,393,000 in 1942.

I. C. C. Rescinds Rate Increases

Freight rate increases averaging 4.75 per cent which became effective March 18, 1942, by authorization of the Interstate Commerce Commission in its Ex Parte 148 proceedings, were suspended by the commission for the period from May 15 to December 31 of this year in a report and order made public April 12. This action resulted from a six-to-five decision in which Commissioner Eastman cast the deciding vote because the other members of the Commission were evenly divided. Joining with Mr. Eastman in the majority were Commissioners Aitchison, Lee, Mahaffie, Splawn and Rogers. Separate dissenting opinions were filed by Chairman Alldredge and Commissioners Johnson, Miller, Patterson and Porter.

Increases in interstate standard passenger fares which became effective February 10, 1942, by the commission's order in the same proceedings, were not disturbed by this decision. Authority for the 10 per cent increase in interstate commutation fares then granted was revoked, however, and provision was made for independent hearings on these fares. Increases approved in rates on milk and cream handled either in freight or passenger trains were suspended along with the freight rate increases.

An exception to the suspension order provided that freight rates that have been reduced voluntarily by the railroads at the instance of federal agencies since the 1942 increases became effective need not be further reduced.

Personal Mention

General

W. H. Hobbs, engineering assistant to the chief executive officer of the Missouri Pacific, has been appointed director of research, with headquarters as before at St. Louis, Mo., a newly-created position.

Willis C. Pruett, whose promotion to superintendent of the Northwestern district of the Missouri-Kansas-Texas, with headquarters at Wichita Falls, Tex., was reported in the March issue, was born at Aberdeen, Miss., on December 3, 1891, and graduated from Sam Houston College, Huntsville, Tex., in 1913. He entered railroad service on June 1, 1913, with the maintenance of way department of the M-K-T, at Smithville, Tex., and in September, 1917, was promoted to yardmaster, with headquarters at Denison, Tex., being granted leave of absence two months later to serve with the Army during World War I. Mr. Pruett returned to the M-K-T in January, 1919, and was appointed instrumentman, with headquarters at Dallas, Tex. In July, 1921, he was advanced to roadmaster at Smithville, and in October, 1924, he was promoted to district engineer, with headquarters at Waco, Tex., being transferred to Muskogee, Okla., five years later. In 1931 Mr. Pruett was appointed general foreman, with the same headquarters and in October, 1936, he was advanced to district engineer at Smithville, holding that position until his new appointment, effective January 10.

C. K. Carter, Jr., whose promotion to superintendent of the Georgia, Southern & Florida was reported in the April issue, was born at Danville, Va., and attended North Carolina State College. He entered railroad service as a section laborer on the Danville division of the Southern in 1921. After serving as inspector, junior engineer, apprentice foreman, assistant supervisor, extra gang foreman and supervisor, he was appointed trainmaster at Columbia, S.C., in December, 1934. Mr. Carter was later transferred to Spartanburg, S.C., and to Greensboro, N.C., remaining at the latter point until his recent appointment.

John W. Purdy, whose promotion to superintendent of the Indianapolis division of the Baltimore & Ohio was reported in the April issue, was born at Springfield, Mo., on September 22, 1891. He entered railroad service in 1907 and worked in various capacities with the Pennsylvania, the Big Four, the Illinois Central and the Pittsburgh, Cincinnati, Chicago & St. Louis (now part of the Pennsylvania) until January, 1917, when he became assistant supervisor on the B. & O., with headquarters at Athens, Ohio. In May, 1917, he was advanced to district bridge inspector at Cincinnati, Ohio, and in December of the same year he was promoted to assistant engineer with the same headquarters. In April, 1920, Mr. Purdy was advanced to assistant division engineer, with headquarters at Chillicothe, Ohio, becoming division engineer at Akron, Ohio, in 1936. In October, 1942, he was promoted to assistant division superintendent at Garrett, Ind., holding that position until his new appointment, effective March 1.

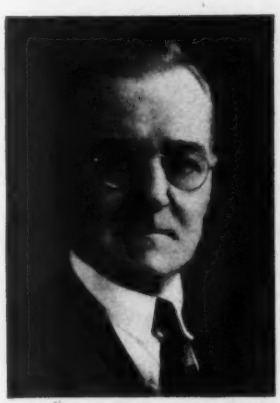
G. R. Haworth, whose election as vice-president of the Western Maryland, with headquarters at Baltimore, Md., was reported in the April issue, was born on June 25, 1888, at Philipsburg, Pa., and entered railroad service in 1905 as a rodman on the Centre & Clearfield. In 1906 he became a rodman on the Buffalo & Susquehanna, and in 1907, a rodman on the Erie at Hornell, N.Y. Later in 1907

G. R. Haworth

he worked as a levelman for the city surveyor at New York, and as a recorder in the marine survey and dredging department of New York, returning to the Erie as a concrete inspector at Cuba, N.Y., in 1908. During 1909, Mr. Haworth was employed as foreman in the Pennsylvania state highway construction department at Pittsburgh, Pa., and as a levelman on the Chicago, Burlington & Quincy. He was promoted to transitman in charge of a field party on the C. B. & Q. in 1910, and later in that year he was employed as surveyor for the United States Engineers. In 1911 he went with the Western Maryland, serving successively as an instrumentman in West Virginia and as a resident engineer at Hagerstown, Md., being transferred to Baltimore in 1912. In 1914 he was employed as an engineer in connection with the construction of the Johns Hopkins Engineering school, returning to the Western Maryland as a resident engineer later in the same year. In 1924, Mr. Haworth was promoted to division engineer in charge of maintenance and construction, remaining in that position until 1936, when he became engineer maintenance of way at Baltimore. He was appointed general superintendent in May, 1940, and in 1941 was promoted to general manager at Baltimore.

L. E. Gingerich, district engineer maintenance of way of the Pennsylvania at Pittsburgh, Pa., has been appointed superintendent of the Delmarva division of that road, with headquarters at Cape Charles, Va. Mr. Gingerich was born on December 7, 1899, at York, Pa. After serving in the United States Army during 1918, he entered Gettysburg college, and graduated in civil engineering in 1922. He was employed for a short time in the Pennsylvania State Highway department, and on December 4, 1922, entered the service of the Pennsylvania as a rodman in the office of the division engineer of the New York division at Jersey City, N.J., subsequently being transferred to the Baltimore division, and later to the Philadelphia division. Mr. Gingerich served as assistant supervisor of track on the New York, Baltimore and Philadelphia divisions, and on July 7, 1928, he was promoted to supervisor of track, in which capacity he served on the Williamsport, Philadelphia and Baltimore divisions. On April 16, 1934, he received a special assignment to rehabilitate the Baltimore Tunnels in connection with the Pennsylvania's electrification of its main line track from Wilmington, Del., to Washington, D.C. On November 16, 1934, he was appointed assistant division engineer of the New York division at Jersey City, and on May 1, 1936, he became division engineer of the St. Louis division, subsequently being transferred to the Chicago Terminal division. On June 1, 1941, Mr. Gingerich was assigned to special duty in the office of the chief engineer at Philadelphia, Pa., and on April 16, 1942, he became engineer maintenance of way of the Western Pennsylvania division at Pittsburgh, the post he held until his recent appointment.

Edward A. Dougherty, assistant to vice-president of the New York Central, with headquarters at Chicago, and an engineer by training and experience, has been advanced to assistant general manager of



George H. Harris

the lines West of Buffalo and the Ohio Central lines, with headquarters at Cleveland, Ohio, and **George H. Harris,** chief engineer of the New York Central system West of Buffalo, has been promoted to assistant to vice-president, with headquarters as before at Chicago, succeeding Mr. Dougherty.

Mr. Dougherty entered the service of the New York Central as a chainman in the engineering department on June 15, 1906, and worked during the summer vacations of 1906-1909 while attending the School of Mines, Columbia University, from which he graduated in civil engineering in 1910. From 1910 to 1917 he

served in the engineering department of the New York Central, in various positions from chainman to assistant engineer, and during this period worked on the electrification between Mott Haven, N.Y., and Croton-on-Hudson, and also on third and fourth tracking at various points. From 1917 to 1919 Mr. Dougherty served in the valuation department as an assistant engineer; from 1919 to 1923, as assistant engineer in the office of the corporate chief engineer and assistant to the president; and from 1923 to February 1, 1926, in the office of the assistant vice-president and vice-president of operation. On February 1, 1927, he was appointed designing engineer in the office of the chief engineer of the lines East of Buffalo, with hadquarters at New York, and on May 1, 1935, he was appointed assistant chief engineer there. In 1938 he was promoted to assistant to the vice-president at Chicago, holding that position until his new appointment became effective on April 1.

Mr. Harris was born at Toledo, Ohio, on July 17, 1878, and received his engineering education at the University of Michigan. He entered railway service in 1901 on the construction of the Detroit & Toledo Shore Line, and in 1902 he became an assistant on the engineering corps of the Pennsylvania at Chicago. A year later, Mr. Harris went with the Michigan Central as an assistant engineer, and in 1905 he was promoted to division engineer, with headquarters at Niles, Mich., but was reappointed assistant engineer with headquarters at Detroit, a year later. From 1907 to 1910, he was assistant engineer in charge of the grade separation project of the Michigan Central and the Chicago, Rock Island & Pacific at Joliet, Ill., and in the latter year he was promoted to division engineer at St. Thomas, Ont. In 1912, Mr. Harris was transferred to Detroit, and in 1913 he was appointed engineer of track, which position he held for three years before being advanced to engineer maintenance of way. During the period between 1917 and 1919, he was acting assistant chief engineer, and in the latter year was appointed special engineer. He served as engineer maintenance of way in 1920-1921 and was promoted to assistant chief engineer in the latter year. On November 1, 1931, Mr. Harris was promoted to chief engineer of the Michigan Central, with headquarters at Detroit, and on October 1, 1939, he was advanced to chief engineer of the New York Central system West of Buffalo (including the Michigan Central), with headquarters at Chicago. One year later, his jurisdiction was extended to include the Big Four and the Peoria & Eastern (also controlled by the N.Y.C.), which position he held until his recent promotion to assistant to vice-president, with headquarters at Chicago.

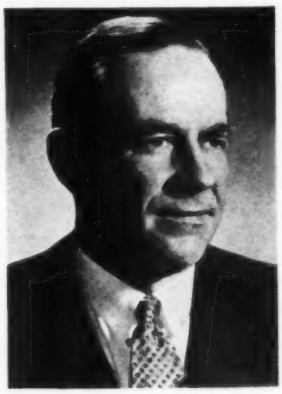
Engineering

Glenn E. Donaldson, an estimator in the valuation department of the Chicago, Rock Island & Pacific at Chicago, has been promoted to chief estimator, succeeding **V. D. Tinkelpaugh,** who died on March 18.

Frank A. Howard, consulting engineer of the Erie, with headquarters at Cleveland, Ohio, retired on April 30, after 47 years railroad service. A biography and photograph of Mr. Howard were published in the March issue.

R. C. Dunlay, district engineer of the Eastern district of the Missouri-Kansas-Texas, with headquarters at Franklin, Mo., has been transferred to the Northern district, with headquarters at Parsons, Kan., succeeding **Fred Hunter,** who, in turn, has been transferred to Franklin, replacing Mr. Dunlay.

Louis H. Powell, whose promotion to assistant to the chief engineer, system, of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, was reported



Louis H. Powell

in the March issue, was born at Baird, Tex., on July 16, 1891, and graduated from Texas A.&M. College. He entered railroad service in 1917 as a computer on the Santa Fe at Amarillo, Tex., and two years later was advanced to accountant, with headquarters at Chicago. In 1920 Mr. Powell was promoted to assistant engineer, with the same headquarters, holding that position until his new appointment, effective March 1.

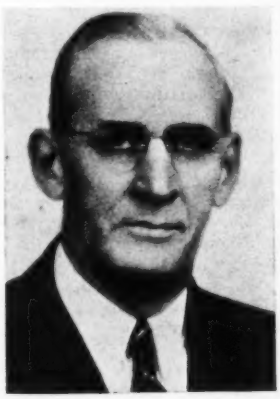
Roy W. Putnam, division engineer of the Rio Grande division of the Southern Pacific at El Paso, Tex., has been promoted to assistant engineer maintenance of way and structures, with headquarters at San Francisco, Cal. **W. M. Jaekle,** assistant division engineer at Oakland Pier, Cal., has been advanced to division engineer at El Paso, succeeding Mr. Putnam.

G. H. Fair, assistant division engineer of the Southern Pacific at Portland, Ore., has been promoted to division engineer of the Tucson division, with headquarters at Tucson, Ariz., succeeding **T. W. Saul,** who has been transferred to the Sacramento division, with headquarters at Sacramento, Cal., replacing **W. F. Turner,** who has entered military service.

Philip M. Stutrud, assistant chief engineer on the Minneapolis & St. Louis, with headquarters at Minneapolis, Minn., has resigned to engage in other work. Mr. Stutrud was born at Blair, Wis., on July 31, 1893, and attended the University of Minnesota and the Chicago Technical College, graduating in civil engineering from the latter in June, 1916. He entered railway service in the engineering department of the M. & St. L. in 1916 and served in various capacities until 1939 when he was promoted to the position he held at the time of his resignation, effective April 1.

Fred Hunter, whose promotion to district engineer of the Northern district of the Missouri-Kansas-Texas, with headquarters at Franklin, Mo., was reported in the March issue, was born at Parsons, Kan., on May 8, 1887, and graduated in civil engineering from the University of Kansas in 1915. He entered railroad service in June, 1914, as a rodman on the St. Louis-San Francisco (Frisco) at Springfield, Mo., and in December, 1915, he became an instrumentman on the M-K-T, with headquarters at Parsons. From September, 1917, to May, 1919, Mr. Hunter served in the U. S. Army, returning to the M-K-T in 1919 as instrumentman and assistant engineer, and in June, 1922, he was appointed roadmaster, with headquarters at Oklahoma City, Okla. In 1923 he returned to the engineering department and worked in various capacities until 1926 when he was appointed roadmaster at Houston, Tex., being transferred to the Osage and Oklahoma divisions, with headquarters at Parsons, in 1939. Mr. Hunter held this position until his recent promotion, effective January 10.

James D. Moffat, Jr., whose promotion to chief engineer of the Western region of the Pennsylvania was reported in the April issue, was born at Washington, Pa., and is a graduate of Washington and

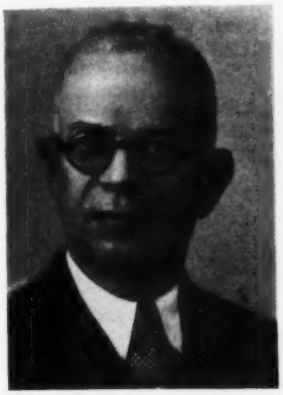


James D. Moffat, Jr.

Jefferson college. He entered railway service in 1907 as a member of the engineering department of the Pennsylvania at Pittsburgh, Pa., and later served on several important projects, including track elevation at Chicago and Indianapolis, Ind. In 1918 Mr. Moffat returned to Pittsburgh, and 10 years later he was granted a furlough to become chief engineer of the Dayton Union Railway Company at Dayton, Ohio, in charge of elevating the tracks owned jointly by the Pennsylvania and other roads serving Dayton. In October, 1934, he returned to the Pennsylvania as assistant engi-

neer, with headquarters at Chicago, and on November 16, 1937, he was promoted to assistant to the chief engineer, holding that position until his new appointment.

Frank J. Jerome, assistant chief engineer of the New York Central system (including the Big Four and the Michigan Central) West of Buffalo, N.Y., has been promoted to chief engineer, with headquarters as before at Chicago, succeeding **George H. Harris,** whose promotion to assistant to vice-president, with headquarters at Chicago, is reported elsewhere in these columns. **Foster H. Simpson,** assistant district engineer of the lines West of Buffalo and the Ohio Central lines at Cleveland, Ohio, has been advanced to assistant chief engineer at Chicago, relieving Mr. Jerome and **Ervin J. Bayer,** assistant district engineer of the Michigan Central, with headquarters at Detroit, Mich., has been transferred to Cleveland replacing Mr. Simpson. **W. H. Miesse,** division engineer of the Big Four at Springfield, Ohio, has been advanced to assistant district engineer at Detroit, succeeding Mr. Bayer, and **W. W. Rohrbough,** assistant division engineer at Bellefontaine, Ohio, has been promoted to division engineer at Springfield, relieving Mr. Miesse.



Frank J. Jerome

Foster H. Simpson

Mr. Jerome was born at Painesville, Ohio, on May 26, 1890, and graduated from Williams College in 1911, and from Massachusetts Institute of Technology in 1914. He entered railway service with the New York Central on July 6, 1914, as a transitman at Elyria, Ohio, and in March of the following year he was transferred to Toledo, Ohio. In 1917, he was appointed assistant engineer at Chicago, and on August 20, 1923, he was promoted to trainmaster at that point. Mr. Jerome was appointed division engineer, with headquarters at Chicago, on November 1, 1927, and in April, 1938, he was promoted to engineer maintenance of way on the Michigan Central, with headquarters at Detroit, Mich. On October 1, 1939, he was advanced to assistant chief engineer of the New York Central system (including the Michigan Central), with headquarters at Chicago. One year later, his jurisdiction was extended to include the Big Four and the Peoria & Eastern (also controlled by the N. Y. C.). He held that position until his new appointment, effective April 1.

Mr. Simpson was born at Fulton, N.Y., on January 18, 1893, and graduated in civil engineering from Rensselaer Polytechnic Institute in 1915. He entered railway service in that year as a rodman on the New York Central at Poughkeepsie, N.Y., and from November, 1917, to July, 1919, he served in France with the U. S. Army. In August, 1919, Mr. Simpson returned to the New York Central as assistant resident engineer, with headquarters at New York, and one year later he was transferred to the New York Terminal district. In April, 1937, he was advanced to assistant engineer, with the same headquarters, and two years later he was promoted to assistant district engineer at Detroit, Mich. In October, 1942, Mr. Simpson was transferred to Cleveland, Ohio, remaining in that location until his new appointment, effective April 1.

Clifford H. Sandberg, whose promotion to assistant bridge engineer, system, of the Atchison, Topeka & Santa Fe, with headquarters at Chicago, was reported in the March issue, was born at Minneapolis, Minn., on September 29, 1901, and graduated in civil engineering from the University of Minnesota, receiving his bachelor's degree in 1926, and his master's degree in 1929. He entered railroad service in 1926 as a draftsman on the Santa Fe at Chicago, and was promoted to assistant engineer in 1930. In 1939 Mr. Sandberg was transferred to Las Animas, Colo., and back to Chicago one year later.

M. W. Beach, whose retirement as bridge engineer of the Northern Pacific was reported in the April issue, was born on April 13, 1889, at Wolcott, N.Y., and graduated in civil engineering from the University of Michigan in 1911. He entered railway service with the Northern Pacific in November, 1912 as a draftsman and designer in the bridge department. In September, 1916, Mr. Beach was advanced to assistant engineer in charge of the valuation of bridges, remaining in the valuation department until June, 1922, except for one year which he spent on construction work. At the end of this period Mr. Beach was appointed assistant engineer in the construction department and in November, 1928, he was promoted to assistant district engineer with headquarters at St. Paul. In March, 1937, following several years on special assignments, Mr. Beach was appointed acting bridge engineer, and was promoted to bridge engineer in June, 1937.

David Warner Fry, whose appointment as principal assistant engineer of the Baltimore & Ohio was reported in the March issue, was born September 20, 1890, at Pratts, Va. Mr. Fry was graduated from the Virginia Polytechnic Institute in 1910, and in June of the same year he entered railroad service with the Mexico North-Western at Medera, Chihuahua, Mexico, as assistant in the engineering corps in the construction of the main line through the Sierra Madre mountains. In December, 1911, he entered the employ of the Baltimore & Ohio as axeman and after progressing through various positions in the engineering department, he was appointed field engineer in July, 1916. Mr. Fry was promoted to assistant engineer in June, 1918, and to senior assistant engineer in April, 1942, which position he held until his recent appointment as principal assistant engineer.

David Warner Fry

William T. Covert, whose retirement as assistant chief engineer of the Pennsylvania system, with headquarters at Philadelphia, Pa., was reported in the April issue, was born at Philadelphia on January 4, 1873 and was graduated from the Pierce School of Business, Philadelphia, and from Cooper Institue, New York. He entered railway service in May, 1890, as a clerk in the accounting department of the Pennsylvania at Philadelphia, and subsequently served as rodman and in various capacities in connection with construction work under the engineer maintenance of way of the United Railroads of New Jersey. From October, 1895, until June, 1897, he was employed in the office of the principal assistant engineer of the Pennsylvania at Altoona, Pa., becoming assistant supervisor of the Philadelphia division on the latter date. In July, 1900, he became supervisor on the Renovo division, and thereafter served successively until October 25, 1917, as supervisor of the Philadelphia yard, assistant engineer of the Chautauqua division, and later on the Eastern & Susquehanna division, and division engineer on the Philadelphia

Terminal division. On October 25, 1917, Mr. Covert was appointed principal assistant engineer of the Western Pennsylvania division at Pittsburgh, Pa., and on March 1, 1920, he became engineer maintenance of way of the Western Pennsylvania division with the same headquarters. He was appointed chief engineer maintenance of way of the Eastern region on June 1, 1926, and on May 1, 1939, was appointed assistant chief engineer of the Pennsylvania system.

Royden R. Brockway, whose promotion to bridge engineer of the Northern Pacific, with headquarters at St. Paul, Minn., was reported in the April issue, was born in Rock County, Minn., on September 17, 1880, and graduated in civil engineering from the University of Minnesota in 1905. He entered railway service on June 17, 1907, as a draftsman in the bridge engineer's office at St. Paul and on November 1, 1910, he was appointed bridge inspector

Royden R. Brockway

at Superior, Mont. On December 21, 1910, he went with the Illinois Central at Chicago, returning to the Northern Pacific on June 26, 1911, as bridge inspector at Glendive, Mont. In November, 1911, Mr. Brockway returned to the bridge engineer's office at St. Paul as a draftsman, and on May 20, 1913, he was promoted to chief draftsman. In November, 1940, he was advanced to the position he held at the time of his new appointment.

L. T. Nuckols, whose promotion to engineer maintenance of way of the Chesapeake & Ohio, with headquarters at Richmond, Va., was reported in the April issue, was born on December 12, 1890 near Rockville, Va., and completed his education at Parkersburg, W. Va. He entered railway service on July 1, 1907, as an employee of the South & Western (now the Clinchfield), and subsequently went with the Louisville & Nashville, where he was engaged in location and construction work, advancing from chainman to assistant locating engineer. For 18 months beginning in 1915, Mr. Nuckols served with the Bureau of Valuation of the Interstate Commerce Commission. He left the commission to enter the service of the C. & O. on October 3, 1916, as a resident engineer and was connected with the construction of the line from Man, W. Va., to Gilbert, and with various other heavy construction projects in West Virginia. On November 20, 1923, Mr. Nuckols was promoted to district engineer at Ashland, Ky., and on January 1, 1932, was appointed resident

L. T. Nuckols

engineer at Huntington, W. Va. On October 6 of the latter year he was appointed assistant division engineer at Ashland, being promoted to division engineer at the same point on June 1, 1936. He was appointed engineer of track on June 1, 1939, and on January 18, 1941, was advanced to assistant chief engineer at Richmond, which position he was holding at the time of his recent appointment.

P. X. Geary, whose promotion to engineer maintenance of way of the Southern division of the Pennsylvania, with headquarters at Wilmington, Del., was re-

P. X. Geary

ported in the March issue, was born at Wilkinsburg, Pa., on March 29, 1891, and was graduated from the University of Pittsburgh in 1913. Immediately thereafter he entered the service of the Pennsylvania as a rodman on the Pittsburgh division at Pittsburgh, Pa. In 1917 he was promoted to assistant supervisor of track at Tyrone, Pa., and subsequently held this position at points on the Buffalo, Cleveland and Pittsburgh divisions until 1927, when he was promoted to supervisor on the Allegheny division at DuBois, Pa. In that year he became master carpenter of the Renovo division at Erie, Pa., and in 1928 returned to the track department as supervisor on the New York division, with headquarters at New York. In 1933 he was promoted to assistant division engineer on the Ft. Wayne division, with headquarters at Ft. Wayne, Ind., and in 1937 he was promoted to division engineer on the Delmarva division at Cape Charles, Va., being transferred to the Philadelphia division with headquarters at Harrisburg, Pa., in April, 1939, the position he held until his recent promotion.

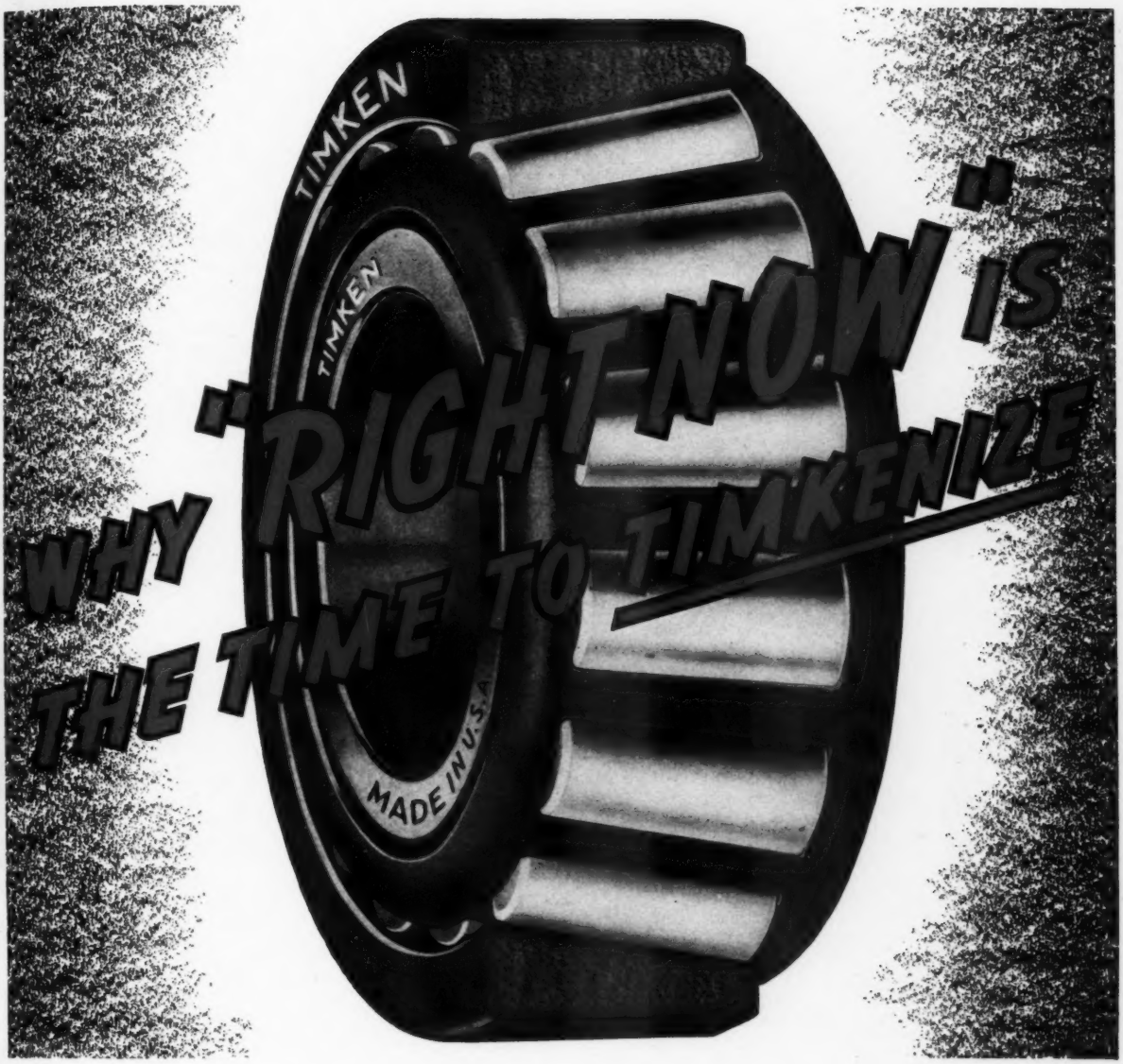
Isaac W. Geer, whose retirement as chief engineer of the Western region of the Pennsylvania was reported in the April issue, was born on February 1, 1873, at Plainfield, Conn., and graduated from Yale University in 1895. He began railway work in the same year with the Pennsylvania lines West of Pittsburgh as a rodman on the staff of the chief engineer, later serving as an assistant engineer. In 1901 he was appointed division engineer maintenance of way, and in

Isaac W. Geer

1902 he was transferred to the Pittsburgh division. From 1904 to 1925 he served as superintendent, general superintendent and general manager and in the latter year, with the consolidation of the Southwestern and Northwestern regions, he was appointed assistant general manager of the Western region, a position he held until September, 1926, when he was advanced to assistant chief engineer. In February, 1927, Mr. Geer was promoted to the position he held at the time of his retirement.

Frank C. Huffman, whose retirement as assistant chief engineer of the Chicago & North Western was reported in the April issue, was born at Milford, Ind., on October 26, 1876, and graduated from Purdue University in 1905, entering railway service with the Cleveland, Cincinnati, Chicago & St. Louis in 1903, prior to his graduation. He entered the service of the engineering department of the Pennsylvania in 1905 and in 1906 returned to the engineering department of the Big Four, leaving in the same year to enter the service of the Chicago & North Western, with which company he has since been identified, except during 1908, when he was assistant state engineer of South Dakota. He served in various capacities in the engineering department of the North Western, including that of assistant resident engineer on the Peoria-

(Continued on page 384)



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Girard line in 1912 and 1913, and was promoted to principal assistant engineer, with headquarters at Chicago in 1918. He was appointed assistant engineer of maintenance in 1920 and in November, 1926, he was advanced to assistant chief engineer, which position he held until his retirement, effective March 31.

Frank C. Huffman

Track

Arthur B. Cox, general foreman on the Tucson division of the Southern Pacific, has been promoted to roadmaster, with headquarters as before at Gila, Ariz.

James F. Nelson, a section foreman on the New York Central, has been promoted to assistant supervisor of track, with headquarters at Carthage, Ind.

Earl R. Bishop, general foreman on the Coast division of the Southern Pacific, has been promoted to roadmaster, with headquarters at Niland, Cal.

C. Rook, track supervisor on the Burlington, has been promoted to roadmaster, with headquarters as before at Orleans, Neb., succeeding **George Green,** who has been transferred to Ferry, Neb. **M. G. Counter,** roadmaster at Ferry, has been transferred to McCook, Neb., replacing **W. F. Jarl,** who has entered military service.

L. W. Seibert, assistant supervisor of track welding of the Chicago, Burlington & Quincy, has been promoted to supervisor of track welding, with headquarters at Chicago, succeeding **S. E. Tracy,** who has been granted a leave of absence for military service with the 745th battalion (Military Railway Service).

P. T. Wynne, whose promotion to track supervisor on the Chattanooga division of the Nashville, Chattanooga & St. Louis was reported in the April issue, was born at Stevenson, Ala., on May 2, 1895, and entered railway service on February 2, 1909. On July 5, 1916, he was promoted to assistant foreman and from 1917 to 1919 he served in the armed forces, returning to the N. C. & St. L., and being advanced to section foreman on November 1, 1923. On February 23, 1927, Mr. Wynne was promoted to the position he held at the time of his new appointment, effective March 15.

Wayne Hutchins, whose appointment as supervisor of track on the New York Central (Big Four), with headquarters at Petersburg, Ind., was reported in the March issue, was born at Stony Point, N.C., on November 26, 1886, and entered railroad service in June, 1904, as a section laborer on the N. Y. C. In 1915 he was promoted to section foreman at Witt, Ill., and was transferred to Irving, Ill., one year later. In 1921 Mr. Hutchins was transfered to Livingston, Ill., and subsequently worked as section foreman and extra gang foreman at Livingston and Hillsboro, Ill.

A. Blaine Hutson, whose appointment as roadmaster on the Chicago, Burlington & Quincy, with headquarters at Beardstown, Ill., was reported in the March issue, was born at De Soto, Wis., on April 3, 1907, and entered railway service on July 15, 1922, as a section laborer on the Burlington at Potosi, Wis. On July 26, 1926, he was promoted to section foreman at Blake, Wis., and on May 1, 1930, he was advanced to extra gang foreman on the La Crosse division. Mr. Hutson was promoted to track supervisor at East Dubuque, Ill., on June 16, 1932, and on November 13, 1941, he was appointed supervisor of track of the Davenport, Rock Island & Northwestern, with headquarters at Davenport, Iowa, where he remained until his recent appointment, effective March 1.

John E. Rogan, Jr., whose promotion to supervisor of track on the Illinois Central at Mendenhall, Miss., was reported in the March issue, was born at New Orleans, La., on November 18, 1911, and graduated in civil engineering from Tulane University in 1933. He entered railroad service on May 11, 1936, as a chainman on the I. C. at Vicksburg, Miss., being advanced to rodman, with the same headquarters within six months. In February, 1941, Mr. Rogan was granted a leave of absence to become senior engineer, railroad construction, at an ordnance plant in Tennessee, returning to the I. C. on November 10 of the same year as instrumentman at Memphis, Tenn. In March, 1942, he was appointed assistant supervisor of new yard construction at New Orleans, and on November, 1942, he was promoted to acting supervisor of track at Mendenhall, holding that position until his new appointment, effective February 19.

L. J. Riekenberg, whose promotion to roadmaster of the Atchison, Topeka & Santa Fe, with headquarters at Chillicothe, Ill., was reported in the March issue, was born at Battle Creek, Neb., on April 1, 1901, and attended the University of Denver, and the University of Kansas. He entered railroad service on February 1, 1926, as a chainman on the Santa Fe at Chanute, Kan., and later served as chainman and rodman at various points on that road until 1933 when he became county engineer of Lincoln county, Neb. In October, 1935, Mr. Riekenberg returned to the Santa Fe as a transitman at Topeka, Kan., and in November, 1937, he was promoted to office engineer, with headquarters at Chillicothe. In June, 1939, he was appointed location engineer at Topeka and in September of the same year he was appointed office engineer at Chillicothe, holding that position until his recent promotion, effective February 22.

Melvin C. Erickson, whose promotion to roadmaster of Subdivision No. 1, Nebraska division, of the Chicago & North Western, with headquarters at Fremont, Neb., was reported in the March issue, was born in Chicago on April 6, 1906, and entered railroad service in June, 1923, as a signal helper on the C. & N. W., at Elmhurst, Ill. He served in various capacities at several points on the road until 1932 when he entered another field. In July, 1935, Mr. Erickson returned to the C. & N. W. as signal helper at Proviso, Ill., and in January, 1936, he was loaned to the Reconstruction Finance Corporation to engage in railroad rehabilitation work at Meridian, Miss., for the Meridian & Bigbee River. He returned to the North Western in 1937 as track inspector, with headquarters at Milwaukee, Wis., and served in a number of capacities until December, 1941, when he was promoted to assistant roadmaster at Boone, Iowa, holding that position until his new appointment, effective March 1.

E. R. Bishop has been promoted to roadmaster on the Southern Pacific at Niland, Cal., succeeding **B. F. Pennington,** who has been transferred to Marysville, Cal., replacing **F. W. Schneegas,** deceased. **H. W. Neuebaumer,** acting roadmaster at Los Angeles, Cal., has been promoted to roadmaster. **J. M. Reddy,** acting roadmaster at Elko, Nev., has been advanced to roadmaster, and **A. B. Cox** has been promoted to roadmaster at Phoenix, Ariz., succeeding **H. Collins** who has retired.

Bridge and Building

W. B. Warfield, assistant master carpenter on the Eastern division of the Pennsylvania, has been promoted to acting master carpenter of the Columbus division, with headquarters at Columbus, Ohio, succeeding **D. E. Wiltsee,** who has been granted a leave of absence.

Coyt A. Hackett has been appointed assistant supervisor of bridges and buildings on the Southern Pacific at El Paso, Tex. **G. L. Emmett** has been appointed general bridge and building foreman at El Paso. **Howard Herrick,** assistant bridge and building supervisor, has been promoted to general foreman of bridges and buildings on the San Joaquin division and **Don Tracy** has been appointed assistant bridge and building supervisor, succeeding Mr. Herrick.

Obituary

Thomas J. Gladwell, who retired in 1941 as supervisor of bridges and buildings on the Pensacola division of the Louisville & Nashville, died on April 12 at his home in Hattiesburg, Miss.

D. C. Fenstermaker, who retired in 1937 as assistant engineer on the Chicago, Milwaukee, St. Paul & Pacific, died at his home at Itasca, Ill., on April 6.

A. L. Mead, who retired on August 1,

(Continued on page 386)

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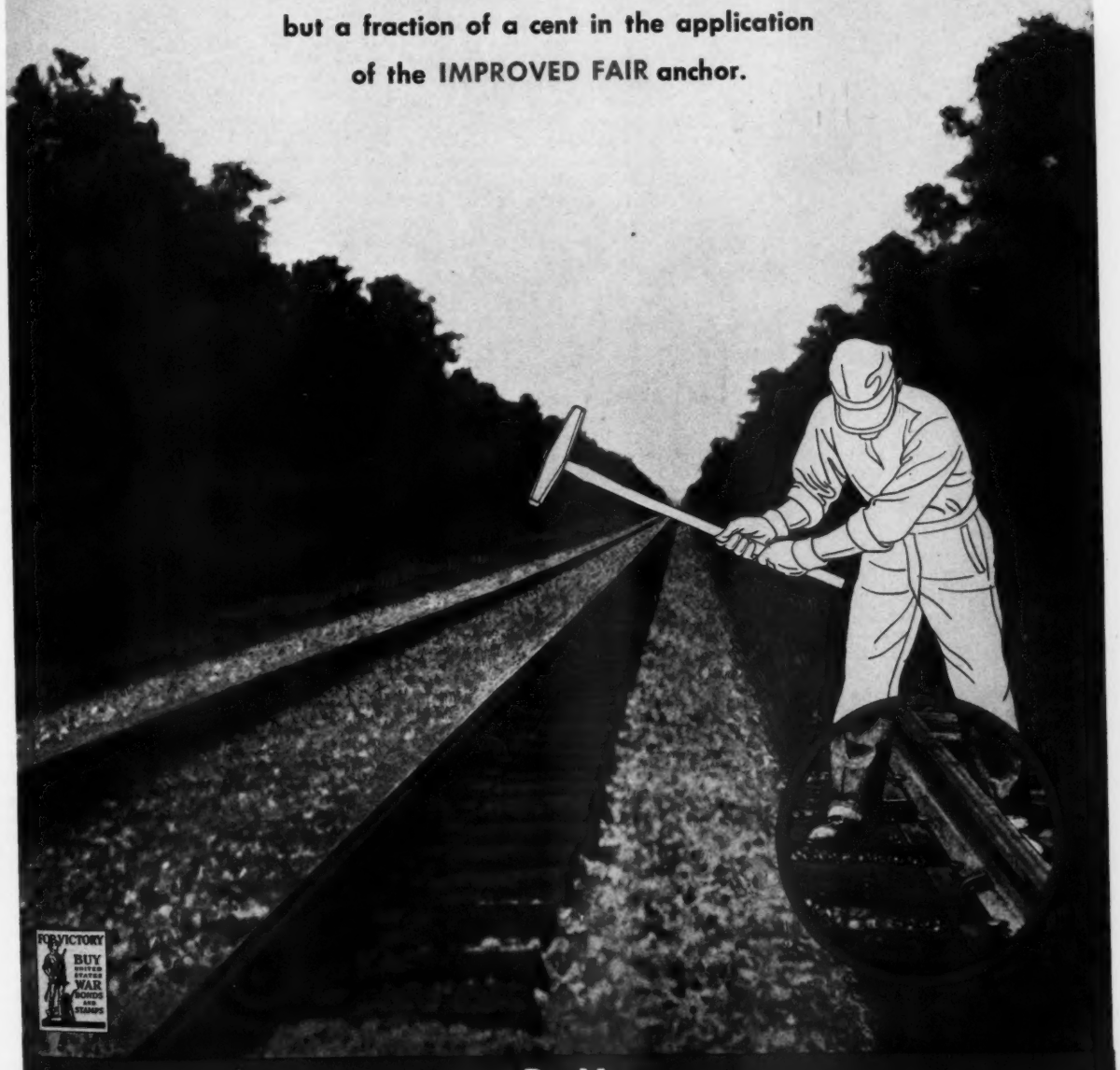

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1920, as roadmaster on the Chicago & North Western, with headquarters at Clinton, Iowa, died at Miami, Fla., on April 14.

H. R. Safford, executive assistant in charge of the Texas Lines of the Missouri Pacific, with headquarters at Houston, Tex., died suddenly on April 10 at Hot Springs, Ark. Mr. Safford was born at Madison, Ind., on February 7, 1875, and graduated from Purdue University in 1895. He entered railway service in the same year as a rodman on the Illinois Central and was promoted to resident engineer in charge of construction in 1897. He was promoted to roadmaster in 1900 and held that position until May, 1903, when he was promoted to principal assistant engineer, with headquarters at Chicago. Mr. Safford was promoted to assistant chief engineer in March, 1905, and in July of the following year was promoted to chief engineer maintenance of way. In May, 1910, he left railway service to become assistant to the president of the American Manganese Steel Company, but returned to railway service a year later, when he was appointed chief engineer of the Grand Trunk (now part of the Canadian National). During the period of federal control, from August, 1918, to March, 1920, Mr. Safford served as engineering assistant to the regional director of the United States Railroad Administration, with headquarters at Chicago. In March, 1920, he was appointed assistant to the president of the Chicago, Burlington & Quincy. On the same date he also became assistant to the president of the Colorado & Southern and the Fort Worth & Denver City. In December, 1921, he was elected vice-president of the Burlington, holding that position until January, 1925, when he was elected executive vice-president of the Gulf Coast Lines and the International-Great Northern, and vice-president of the Missouri Pacific. His title was later changed to executive assistant in charge of the Texas Lines of the Missouri Pacific. Mr. Safford was active in the work of the American Railway Engineering Association and was president of that organization in 1920-1921. He also served one term as counsellor of the Engineering Institute of Canada. He took a keen interest in activities of the Boy Scouts of America in many of the Southern and Southwestern States.

H. R. Safford

Association News

Roadmasters' Association

President Banion has called a meeting of the Executive committee in Chicago on May 8.

Wood-Preservers' Association

Approximately 125 members and others interested in the preservation of timber gathered in Chicago on April 27 for the 39th annual meeting. This meeting was confined to morning and afternoon sessions on the one day, at which reports of various committees were presented and accepted.

Officers were elected for the ensuing year as follows: President, R. H. Colley, engineer, Bell Telephone Laboratories, New York; first vice-president, Walter P. Arnold, technical director, Wood Preserving division, Koppers Company, Orrville, Ohio; second vice-president, S. D. Hicks, vice-president, Southern Wood Preserving Co., Pittsburgh, Pa.; treasurer, re-elected, Horace L. Dawson; members of the Executive committee: J. S. Giddings, inspector, treating department, Atchison, Topeka & Santa Fe, Topeka, Kan.; and G. B. McGough, superintendent, Bond Brothers, Louisville, Ky.

Bridge and Building Association

Carrying forward the work of the asso tion unabated, a full-day meeting of the Executive committee was held in Chicago on April 12, attended by President G. S. Crites; Third Vice-President Neal D. Howard; Fourth Vice-President J. L. Varker; the recently-appointed Secretary, Elinor Heffern; Directors Martin Meyer, J. S. Hancock and L. C. Winkelhaus; and Past-Presidents R. E. Dove; A. E. Bechtelheimer, C. R. Knowles, T. H. Strate, C. Miles Burpee, and Elmer T. Howson. At this meeting, the committee considered the status of membership at length and passed favorably upon three applications, gave consideration to the status of work on the reports to be presented before the next annual meeting, and transacted considerable association business of a routine nature. It was reported that work on the 1942 Proceedings is progressing, with the hope that the volume can be made available to memberes by early summer. The next meeting of the Executive committee was scheduled tentatively for late in July.

Railway Tie Association

The twenty-fifth annual meeting of the Railway Tie Association will be held at the Hotel Statler, St. Louis, Mo., on May 4. In deference to the needs of our national emergency, the meeting will be confined to one day, with morning and afternoon sessions and with luncheon and dinner addresses. St. Louis has been selected as the convention city in recognition of the fact that this is the silver anniversary of the organization of the association in St. Louis. The meeting will convene at 9:30 with the following program:

Address of President, David W. Bauer, St. Louis.
Report of Committee on Manufacturing Practice; W. J. Chambliss, chairman, Bond Brothers, Inc., Louisville, Ky.
Report of Committee on Mechanical Equipment; W. D. Humphrey, chairman, Wood Preserving Division, Koppers Co., Memphis, Tenn.
Address on the 25th Anniversary of the Railway Tie Association, by E. E. Pershall, chairman of the board, T. J. Moss Tie Co., St. Louis.
Report of National Councilor, Delegate to the Conference of the United States Chamber of Commerce; George H. Curran, Wood Preserving Division, Koppers Co., Pittsburgh, Pa.
Report of Committee on Timber Conservation; Meyer Levy, chairman, T. J. Moss Tie Co., St. Louis, supplemented by address by Paul D. Kelleter, forester, Ironton, Mo.
Address on How Revised MPR-216 Has Affected the Crosstie Industry, by T. J. Turley, Bond Bros., Inc., Louisville, Ky.
Report of Legislative Committee; B. N. Johnson, chairman, Wood Preserving Division, Koppers Co., Richmond, Ind.
Report of Committee on Checking and Splitting Ties; Walter H. Firmin, chairman, Wyoming Tie & Timber Co., Metropolis, Ill.
Report of the representative of the Railway Tie Association on the Lumber and Timber Products War committee; Leonard Perez, Wood Preserving Division, Koppers Co., St. Louis.
Election and installation of Officers.

The association will hold a luncheon at noon at which A. A. Miller, chief engineer maintenance of way, Missouri Pacific, will speak on The Railroads and the War Effort. The annual dinner will be held in the evening with an address by Carleton S. Hadley, general counsel, Wabash railroad, on The Railroads and the War Agencies.

Maintenance of Way Club of Chicago

Breaking all records for attendance, 181 members and guests attended the annual meeting of the club on the evening of April 26, features of which were the election of officers for the ensuing year and a round-table forum on The No. 1 Maintenance Problem of 1943-Labor. In the forum, which was conducted by Elmer T. Howson, chairman of the club's program committee and editor, *Railway Engineering and Maintenance*, the following railway officers, all sitting at the speaker's table, participated: H. R. Clarke, chief engineer, Chicago, Burlington & Quincy; Armstrong Chinn, general manager, Alton; C. G. Grove, chief engineer maintenance of way, Western region, Pennsylvania; E. C. Vandenburgh, engineer maintenance, Chicago & North Western; W. G. Powrie, engineer maintenance of way, Chicago, Milwaukee, St. Paul & Pacific; and C. H. Hardwick, engineer maintenance of way, Chicago, Rock Island & Pacific. Speaking to questions, the various participants in the round-table discussion first outlined the character of the labor problem in their specific territories and then discussed the various expedients that are being employed to secure additional labor and to hold existing forces.

In the election of officers, F. G. Campbell assistant chief engineer, Elgin, Joliet & Eastern, was advanced from first vice-president to president; W. S. Lacher, secretary, American Railway Engineering Association, was advanced from second vice-president to first vice-president; C. C. Pelley, track supervisor, Illinois Central, was elected second vice-president; and Neal D. Howard, managing editor, *Railway Engineering and Maintenance*, was re-elected secretary-treasurer. In addi-

(Continued on page 388)

"RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS"

"Paper Restrictions"

"Boss—what will these new restrictions in the use of paper do to that new catalog that you've been talking about so long?" asked the star railway salesman of his sales manager.

"I don't know yet, Bill, but I'm afraid it's out for the duration," replied the sales manager.

"That's too bad, for we certainly need it, with so many new men coming into the railway field."

"That's what's *worrying* me. We've got to find some other way to tell them what our equipment will do for them."

"It can be a life saver for a lot of 'em this year, when they're so short of men."

"That's true, if they can only be told of it."

"Why can't we advertise?"

"Where?"

"In *Railway Engineering and Maintenance.* It reaches all these railway maintenance men—and they read it too. It's their Bible."

"Bill, you've got something there. We *can* advertise our story, catalog or no catalog."

"We can tell our story in a new way in *every* issue."

"We'll keep our equipment before them *every* month."

"And we'll let the publisher worry about the paper restrictions."

tion, Guy P. Palmer, engineer maintenance and construction, Baltimore & Ohio Chicago Terminal; R. L. Cochrane, assistant engineer, Atchison, Topeka & Santa Fe; and G. H. Larson, the Rail Joint Company, were elected directors for a term of two years. The membership of the club at the end of the year was 340.

American Railway Engineering Association

On April 1, the association's booklet containing the assignments and personnel of committees for the current year was mailed to all committee members. Details relative to newly-appointed committee chairmen and new subject assignments were published in our April issue.

Because the annual convention was not held this year and discussion of committee reports had to be carried on by mail, the editing and publication of the 1943 proceedings will be delayed somewhat, but will soon be ready for the printer; it is anticipated that copies can be distributed to members about June 15.

Returns have been received from the letter ballot on recommendations of committees for additions to or revisions of the Manual. All propositions received affirmative vote and will be published in the forthcoming 1943 supplement to the Manual, with the exception of two items reported upon by the committee on Roadway and Ballast, namely: Natural Waterways—Prevention of Erosion; and Specifications for Corrugated Structural Plate Culverts and Arches, which were withheld from the ballot by the Board of Direction. The supplement to the Manual will also be distributed to members about June 15.

Five committees of the association held meetings in April as follows: Committee on Impact on April 1 at Chicago; Economics of Railway Labor on April 9 at Chicago; Water Service, Fire Protection and Sanitation on April 13 at Chicago; Buildings on April 20 and 21 at New York; and Economics of Railway Location and Operation on April 27 and 28 at Chicago. Only one meeting is thus far scheduled in May, the Committee on Rail, which will meet in Chicago on May 11.

Supply Trade News

General

The **American Hoist & Derrick Company** has moved its Chicago office from 208 W. Washington street, to the Conway building, 111 W. Washington Street.

Young & Greenawalt, drainage specialists, East Chicago, Ind., will open a Chicago office at 332 So. Michigan avenue on May 1, with **P. J. Spears** in charge.

The Whiting Corporation, Harvey, Ill., has been awarded the Army-Navy "E" pennant for excellence in war production, the presentation ceremonies being held on April 20.

More than 4,000 **Johns-Manville** employees and members of their families gathered in an auditorium in the company's Manville, N.J., plant on March 24, to witness the formal raising of the Army-Navy "E" flag, awarded for excellence in war production work. The presentation was made by Major-General Thomas E. Robins.

Personal

Howard M. Givens, Jr., manager of tool steel sales for the **Allegheny Ludlum Steel Corporation,** Brackenridge, Pa., has been transferred to the corporation's Dunkirk, N.Y., offices.

Frank S. O'Neil, general manager of the Indianapolis, Ind., plant of the **Link-Belt Company,** has been appointed vice-president, to succeed **James S. Watson,** who, after 50 years of service with the company, will retire from active duty, but will continue as a director of the company.

Dr. Edgar C. Bain, since 1938 assistant to the vice-president in charge of research and technology for the United States Steel Corporation of Delaware, has been appointed vice-president in charge of research and technology, for the **Carnegie-Illinois Steel Corporation,** United States Steel subsidiary. The establishment of this new vice-presidency is for the purpose of further intensifying these activities for the company's war effort.

Obituary

Edward E. Barrett, president of the Roberts & Schaefer Company, Chicago, from 1926 until he resigned in January, 1937, died at Boca Raton, Fla., on April 21. Mr. Barrett was 72 years old and had been in ill health for several months due to a heart ailment.

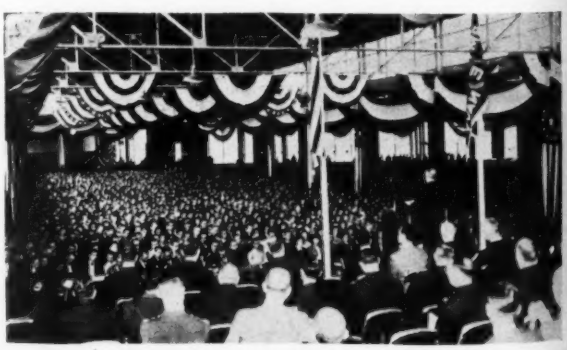
A. Reamy Joyce, district sales manager of the Wood Preserving Division of the Koppers Company, with headquarters at Marietta, Ohio, died suddenly in that city on April 7. Mr. Joyce was born at Cincinnati, Ohio, on November 28, 1883. He attended the U. S. Naval Academy, Annapolis, Md., for 2½ years and graduated from the University of Minnesota. In 1910 Mr. Joyce joined the sales department of the Joyce-Watkins Company, Chicago, where he devoted most of his time to introducing treated timber to coal mines. He was also the author of several treatises on the economics of treated timber in mines. In 1914 he was elected vice-president of the company, but continued to give his entire time to sales. In 1933 Mr. Joyce resigned from the Joyce-Watkins organization and became district sales manager of the Wood Preserving Corporation (now the Wood Preserving Division of the Koppers Company), with headquarters at Marietta, Ohio, which position he held at the time of his death. Mr. Joyce has long been active in the American Wood Preservers' Association, serving as president of that association in 1920 and as chairman of the Committee on Diversified Uses of Treated Wood at the time of his death.

A. Reamy Joyce

Trade Publications

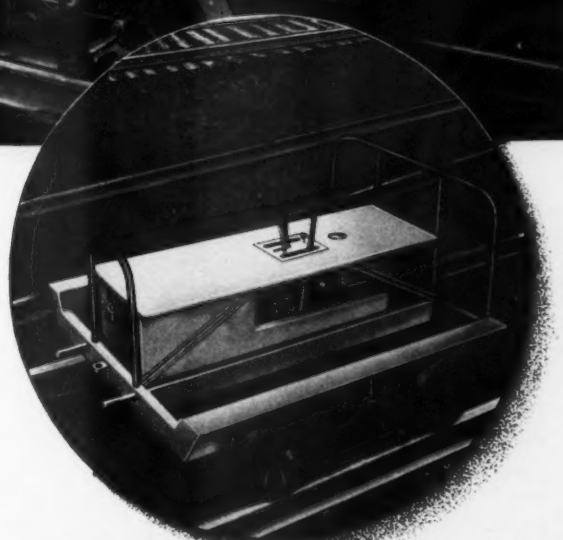
Armco Emergency Wood Pipe.—An eight-page catalog has been published by the Armco Drainage Products Association, Middletown, Ohio, describing its Armco Emergency Wood Pipe which was developed by this company to meet wartime conditions. The catalog describes the construction of the pipe and presents tables of specifications and weights for various sizes. It is attractively illustrated with numerous installation photographs.

Wrought Iron for Underground Services.—A 36-page bulletin with this title has been published by the A. M. Byers Company, Pittsburgh, Pa., which discusses the most important factors affecting soil corrosion of underground piping and outlines installation histories of water wells and lines, gasoline lines and tanks and electrical cable conduit. The bulletin is attractively printed and includes many photographs of underground piping installations.

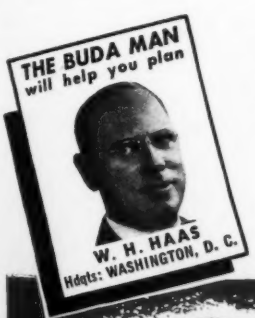


Commander A. S. Kibbee, U. S. Navy, Addressing More than 4,000 Johns-Manville Workers and Their Families, at the Army-Navy "E" Award Ceremonies at Manville, N. J., on March 24, 1943.

A DOUBLE-DUTY, 1,200-lb. capacity car for one to eight man section gangs plus their equipment, the Buda "Sectionmaster" offers every feature for maximum safety and unequalled economy. With its powerful 7.7 hp. aircooled 4-cycle engine, the Sectionmaster can handle light trailer loads (2-speed reduction gear available for heavier loads).



• Above are loaded and unloaded views of the Buda "Sectionmaster." Construction features include all-welded frame, spring-mounted pedestal bearings and 4-wheel self-centering brakes.



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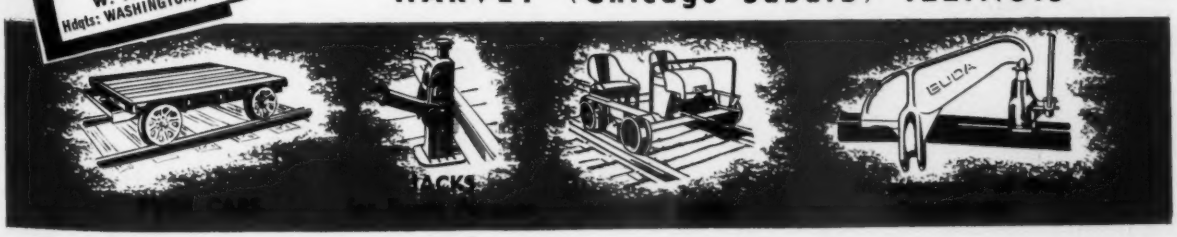
THE BUDA COMPANY

HARVEY (Chicago Suburb) ILLINOIS



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has long life built right into it..

Anti-friction bearings at 20 different points in AMERICAN Locomotive Cranes eliminate friction losses and save the power for productive work. In addition, they eliminate excessive wear and lengthen the life of the crane.

When new equipment is practically unobtainable except for vital war work it is most important that machines on hand be carefully maintained at the highest possible point of efficiency. Here are three vital protective measures:

1—Regular — and frequent — lubrication.
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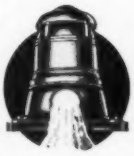
New Worlds To Conquer



In the present war emergency, the service provided by Layne has been of inestimable value. Thousands of highly efficient well water systems for military, naval, munition and war material needs have been constructed in unbelievably short periods of time.

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When peace returns, the Layne organization will be ready to provide an incomparable service. There will be pumps of improved design to further increase high efficiency, tougher materials to add more years of long life, unmatched manufacturing facilities to speed production and hundreds of thoroughly trained men for field and service duty.

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LAYNE

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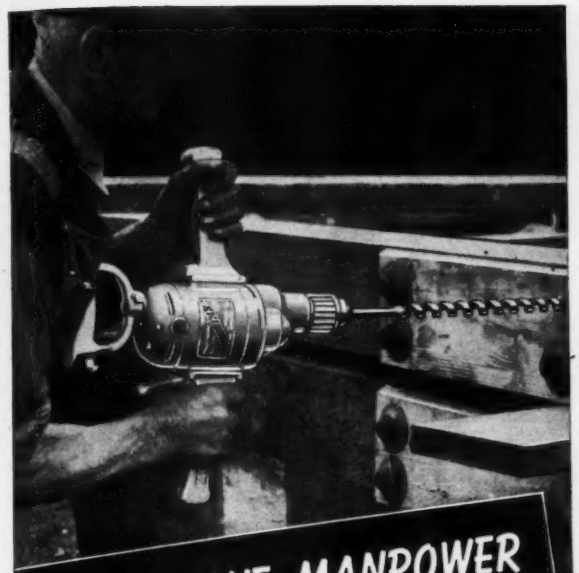
DEEP WELL PUMPS

Builders of Well Water Systems for Every Municipal and Industrial Need



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● Your Bridge and Building Crews will get more work done... *in less time*... when they're equipped with SKILSAW DRILLS. These tools have the *extra* power that means *extra* speed on every operation... from lightest repair drilling to deepest boring in bridge timbers. Yet SKILSAW DRILLS are lighter, more compact ... for *easier* handling on *more* jobs!

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SKILSAW PORTABLE ELECTRIC TOOLS
★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

AND WE HAD "*Real Bread*"

"Our boys," in distant lands, get *real bread* — made the American way in "portable" kitchens. Just another way Briggs & Stratton gasoline motors are serving — furnishing power for bread mixers, refrigerators, water supply and other specialized applications — in addition to scores of major standard uses.

We're in full production on Briggs & Stratton 4-cycle, air-cooled gasoline motors — both for the war program and for approved "essential" civilian uses — but there are not enough "new" motors available to supply the demand.

As a special service, we are trying to place "used" Briggs & Stratton motors that may not now be in active service, in the hands of those who need them so badly.

If you have, or know of any Briggs & Stratton motors not now in regular use — please write us, stating model numbers and general condition. It makes no difference how old they are. We will assist in making contacts between owners and prospective purchasers.

BRIGGS & STRATTON CORP.
MILWAUKEE, WIS., U. S. A.

FOR VICTORY
Invest in
WAR BONDS

4 CYCLE
BRIGGS & STRATTON
GASOLINE MOTORS

Mall
TRADE MARK

PORTABLE POWER Tools

KEEP MAINTENANCE MOVING

Mall CHAIN SAW

5 H. P. **GASOLINE ENGINE MODEL**

A powerful, time and labor-saving tool that squares heavy timbers and logs to size, and fells trees with surprising speed. Automatic clutch prevents stalling the engine when saw is pinched or forced too hard. Eliminates hand clutch control. Only necessary for operator to manipulate engine throttle when ready to cut. Swivel feature permits cutting at necessary angles. Motorized sharpening device for sharpening right on the job. Easily transported on a hand car. Available in 24", 36" and 48" cutting capacities. Also pneumatic models.

NEW Mall 1/4" DRILL 143T

A light-weight, cool running drill for continuous metal drilling under full load. Has free speed of 2850 r.p.m. and full load speed of 1850 r.p.m. Pistol grip and trigger switch simplifies use with either hand. Equipped with universal motor and ventilating fan. Easily and quickly serviced.

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The 5 H. P. variable speed gasoline engine operates 8 quickly interchangeable tools for Circular Sawing, Grinding, Sanding, Drilling, Pumping, Wire Brushing, Concrete Vibrating, Concrete Surfacing and Sharpening Tools. It operates all day on very little fuel. The flexible shaft that transmits power to tools is properly insulated to protect signals. Off-the-track feature reduces accident hazards.

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You'll find Douglas Fir Plywood doing important work in every Boeing B-17 Flying Fortress!

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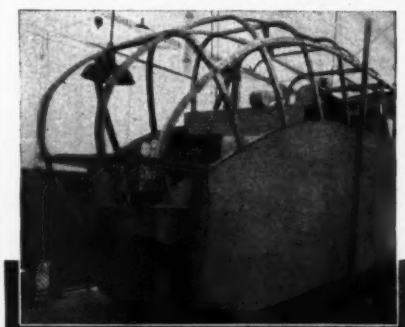
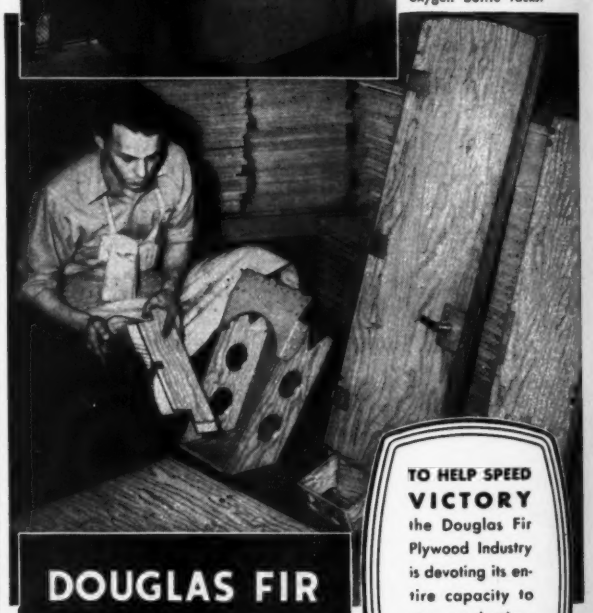


(Left) "Mock-up" of a proposed Boeing plane. These full-size models constructed largely of Douglas Fir Plywood help engineers perfect designs.

(Below) Douglas Fir Plywood aids every Boeing Flying Fortress in its missions of destruction. Standard equipment includes Plywood compartment doors, flooring and step assemblies, radio equipment tables and oxygen bottle racks.



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Real Lumber

MADE LARGER, LIGHTER
SPLIT-PROOF
STRONGER

TO HELP SPEED VICTORY the Douglas Fir Plywood Industry is devoting its entire capacity to war production. We know this program has your approval.

SEND FOR WAR USE FOLDER!

Dozens of actual photographs show you how Douglas Fir Plywood is aiding the war effort. Write Douglas Fir Plywood Association, Tacoma, Wash., today for your free copy!

INDUSTRIAL BROWNHOIST CRANES ARE GETTING THINGS DONE FOR UNCLE SAM!

In steel mills, coal yards, shipyards, railroads and other war plants all over America, I. B. Cranes are working night and day moving heavy materials, getting things done in a hurry. I. B. Cranes are doing their jobs continuously—seldom if ever requiring time out for repairs. They're powerful—handling the tough jobs with ease. They're efficient—they get more work out of a gallon of precious fuel oil than rightfully could be expected. If you're interested in speeding up your share in America's war effort, I. B. Cranes can help you. Write to Industrial Brownhoist Corporation, Bay City, Michigan. District offices: New York, Philadelphia, Pittsburg, Cleveland, Chicago.

INDUSTRIAL BROWNHOIST BUILDS BETTER CRANES

For Victory — the unbeatable combination . . . JACKSON TAMPERS and the MULTIPLE JACK METHOD

To Win the Battle of Good Track . . .

Employ this method for uniform raising and tamping. Eliminate tamping joints or jack ties ahead of tampers. Tie renewals are made easier, faster.

Only with your **vibratory Jackson Tampers** can you take full advantage of the multiple jack method, because they compact a maximum amount of ballast **uniformly** under each tie. For complete details, write for our free booklet.

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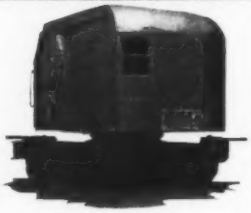
BURRO CRANES

Designed . . .
Engineered . . .
and Built
for . . .

railway use by specialists in **railway** cranes, BURRO CRANES have the features important in **railroad** use.



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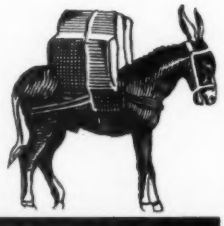
Extra Draw - Bar Pull (7,500 lb.)—frequently eliminates need for work train service.

Easy Access from Rear

Low Over-All Height (10′ 7″) — can travel to work on Flat car.

Elevated Boom Heels

Fast Travelling Speed — get around the job at 20 m.p.h.



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Furnished either of Rolled and Forged Open Hearth Steel, or of Alloy Cast Steel, both Heat-treated for maximum strength and resistance to impact. Allowance for wear on rails is made when specified to provide the best possible connection.

Dies and patterns are available for the manufacture of joints for practically any combination of rail sections.

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By CHARLES H. BARTLETT

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Written to meet today's exacting standards for curve maintenance, this booklet presents in detail a method of proven practicability for checking and correcting curve alinement readily with tools that are at hand. It makes possible the accurate realinement of curves without engineering instruments or other appliances than a string and a rule.

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A comprehensive, versatile, all-year-round unit that will help greatly in keeping your right-of-way in condition to handle peak war traffic

Ditches out cuts
Spreads the fill
Shapes the ballast
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Jordan equipment is too valuable to be out of service. Guard against this! Check your maintenance now—and order any needed replacement parts as early as possible.

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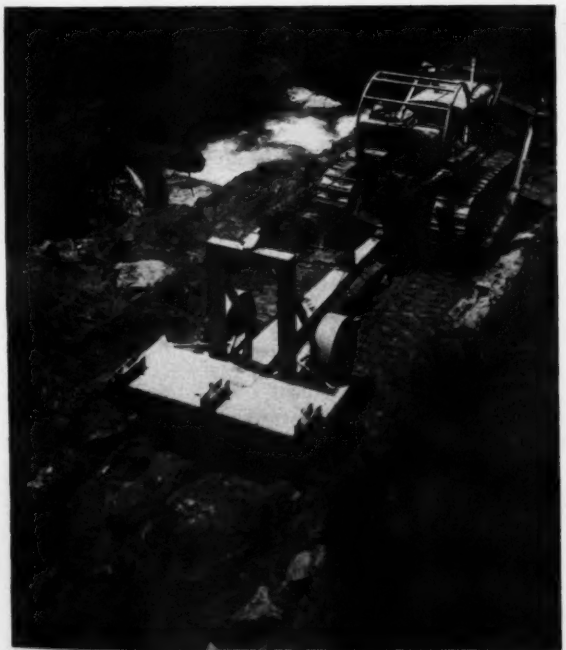

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(above) LeTourneau Rooter ripping up rocky ground so LeTourneau Dozer on front of tractor can excavate for logging railroad in Idaho.

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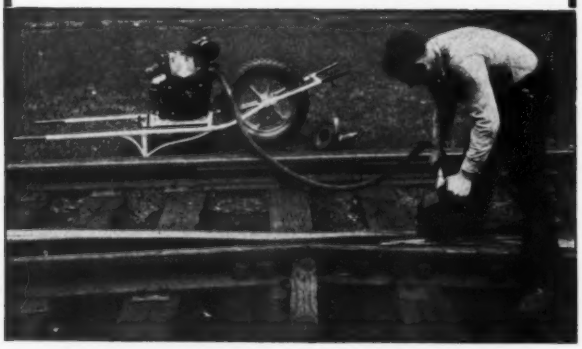
Peoria, Illinois • Stockton, California
HEAVY CONSTRUCTION EQUIPMENT

STEEL AND MUSCLE CONSERVATION

With both steel and manpower scarce, efficient power-driven maintenance equipment becomes doubly valuable. That goes for Railway Track-work rail grinders. Keep them busy to save your rail. Their rugged construction, ease of operation and efficient performance make them outstanding parts of your track maintenance equipment.

Many models available. Write for latest data bulletins.



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in production of the tools that safeguard the accuracy of American Industry . . .

We, at the Lufkin Rule Company, are proud to have received the Army-Navy award in recognition of the quality and quantity of precision measuring tools we have produced. Scarcely a single part of the vast supply of war equipment America today is producing can be made without the aid of precision tools, measuring tapes or rules.

In accepting this award, we pledge ourselves to ever greater production efforts until the final victory has been won.

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PRECISION TOOLS • TAPES • RULES

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Use this section when seeking a new man, new position, or when buying or selling secondhand equipment.

CLASSIFIED ADVERTISEMENTS, $10.00 an inch, one inch deep by three inches wide, an insertion.

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Remittance must accompany each order.

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A man to represent a large, well-known Railway Equipment manufacturer. Can assure proper man with a good steady income and growing post-war business. Must be willing to travel extensively, and be familiar with the design and installation of electrical devices, and signal and track circuits. Give full particulars in first letter stating experience, education, and past earnings. Address Box 543, Railway Engineering and Maintenance, 105 W. Adams St., Chicago.

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16, 20, 24 or 30 cubic yard AIR DUMP CARS. Any quantity, type, make or location. Also 10- to 30-ton Gas or Diesel Locos.

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38 years' experience
13486 S. Brainard Ave., Chicago, Illinois
"ANYTHING containing IRON or STEEL"

NEW AND SLIGHTLY USED SOLID MANGANESE RAILROAD CROSSINGS

Less Than Half Price

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FASTER DRIVING! FULL PROTECTION!

With This Improved

WELDED STEEL PILE SHOE

AVAILABLE for SHIPMENT ON SHORT NOTICE

● Saves Time ● Saves Trouble
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The Morrison Welded Steel Pile Shoe is slipped over sharpened pile and fastened in place by driving nails through holes in four wing points. Wing points may be easily hammered into position (without danger of breakage) to conform to shape of pile.

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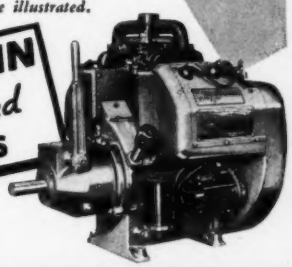
Machine designing engineers, contractors, farmers, oil operators and industrial users are more and more recognizing the amazing versatility, heavy-duty dependability, fit-the-machine compactness, light weight and economy of WISCONSIN AIR-COOLED ENGINES. Specify these engines for *today's* work as well as for *tomorrow's* applications.

Power range: 1 to 35 hp., 1 and 4-cylinder types. Model VE-4, 22 hp., 4-cylinder V-type illustrated.



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WISCONSIN MOTOR Corporation

MILWAUKEE, WISCONSIN, U. S. A.

World's Largest Builders of Heavy-Duty Air-Cooled Engines

"Slim Jim" Jacks for Trestle Work

Simplex No. 310. 15-tons capacity; 22¼" high; 13" lift. Toe lift 2½" from ground level. Wgt. 66 lbs. (without accessories)

The 3⅞" wide base (5" width optional) of this jack readily fits between close spaced ties on bridges, trestles and viaducts. Speeds lining, surfacing, spacing, bolt pulling, etc.

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Cutting Maintenance-of-Way Costs Since 1899

Make Your Jacks Last Longer!

Don't abuse them by overloading. Don't use one jack where two or more are needed.

Simplex
LEVER · SCREW · HYDRAULIC
Jacks

NO ASPHALT PERMITS REQUIRED

FOR

OHIO VALLEY ROCK ASPHALT CO.
KENTUCKY
BITUROC
TRADE MARK
ROCK ASPHALT
LOUISVILLE, KENTUCKY

"Natural" Kentucky Rock Asphalt

Crossing Pavements
Station Platforms

(Prices and information on request)

PATCH FLOORS

. . . While Traffic Rolls

Here's a new, fast way to patch broken concrete without having to close off the area. Use durable INSTANT-USE . . . a tough, plastic material which you simply shovel into hole — tamp — and run traffic over immediately. NO WAITING. Bonds tight to old concrete. Makes smooth, solid, heavy-duty patch. Withstands extreme loads. Keep a drum on hand for emergencies. Immediate shipment.

REQUEST DESCRIPTIVE FOLDER
And Details of FREE TRIAL OFFER

INSTANT-USE

FLEXROCK CO., 2347 Manning St., Phila., Pa.

★ ★ ★ ★

WAR RIDES THE RAILS

Ballast compacted uniformly makes a roadbed that "can take it." And vibratory JACKSON TAMPERS do just that to ballast.

These highly efficient roadbed tools are helping railroads to maintain the kind of track necessary for the heavy traffic of war. Their simplicity of operation helps with the manpower problem. And they can cover a lot of track quickly.

JACKSON

ELECTRIC TAMPER & EQUIPMENT CO.
LUDINGTON, MICHIGAN

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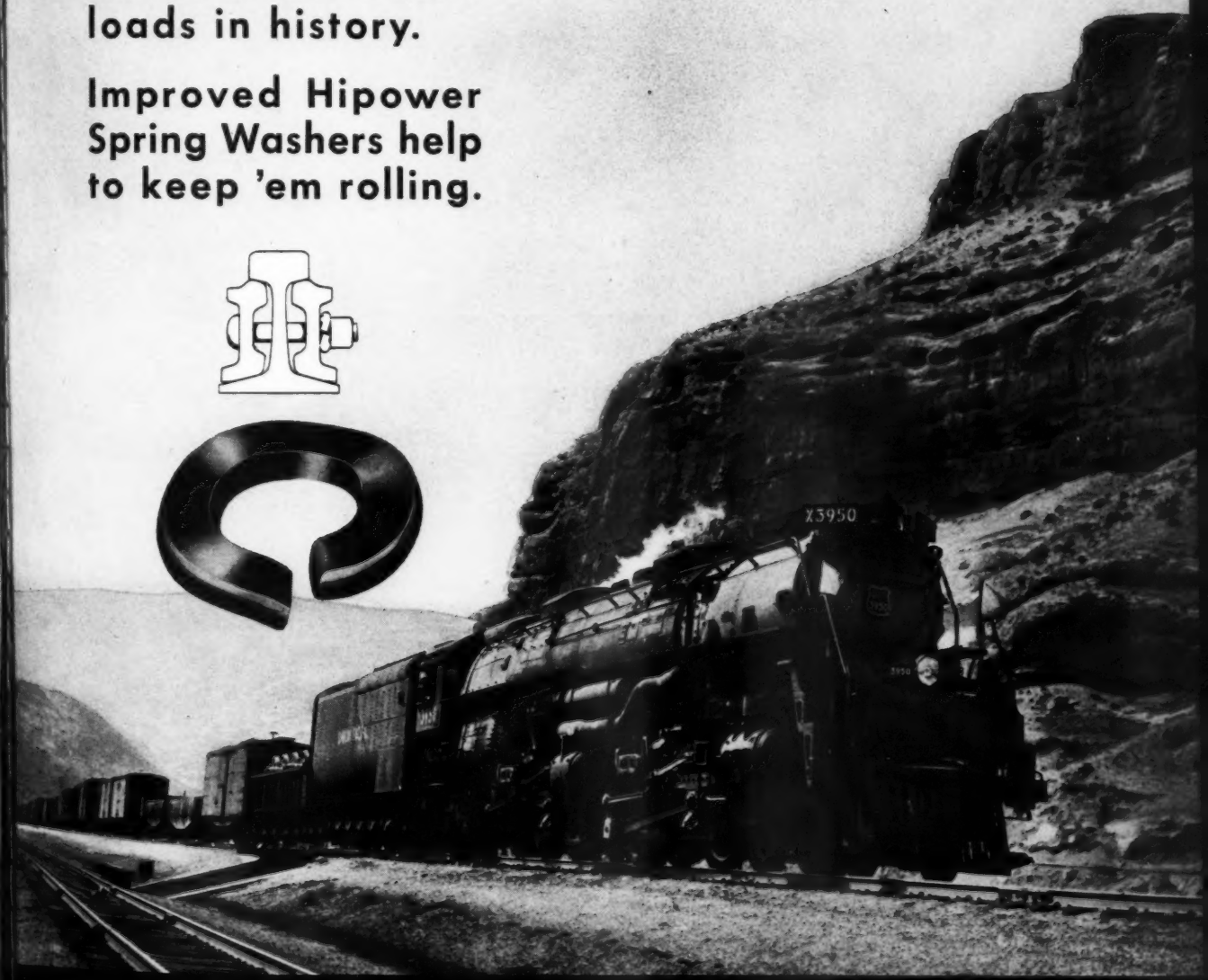
IMPROVED HIPOWERS

IMPROVE TRACK

Today the railroads are confronted with the heaviest traffic loads in history.

Improved Hipower Spring Washers help to keep 'em rolling.



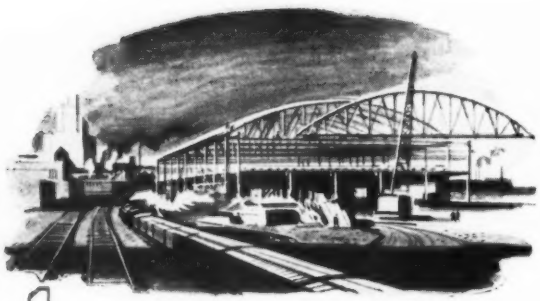
THE NATIONAL LOCK WASHER COMPANY, NEWARK, N. J., U. S. A.

A COMPLETE LINE OF RAILWAY SPRING WASHERS

Koppers "C & C" Projects*

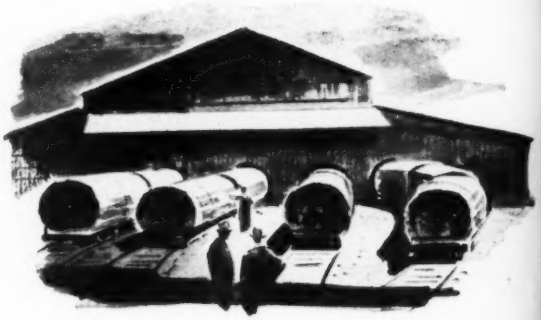
*Current and Contemplated

Wood Preserving Division



1 Current

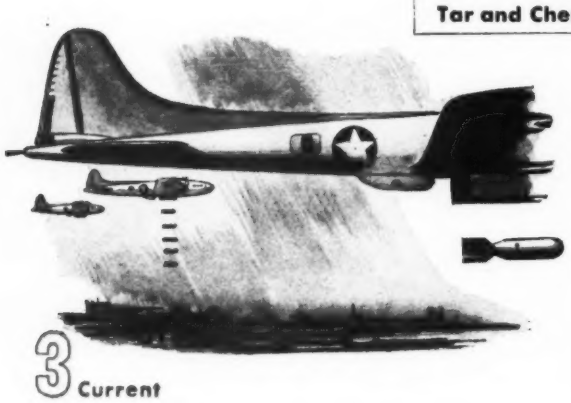
Pressure-treated timber replaces critical metals to speed war production—The proven ability of pressure-treated timber to serve for years under extreme conditions of exposure provided a huge reservoir of construction materials for American war industries and for essential civilian uses. Millions of board feet have been pressure-treated in Koppers plants to resist fire, decay and insects.



2 Contemplated

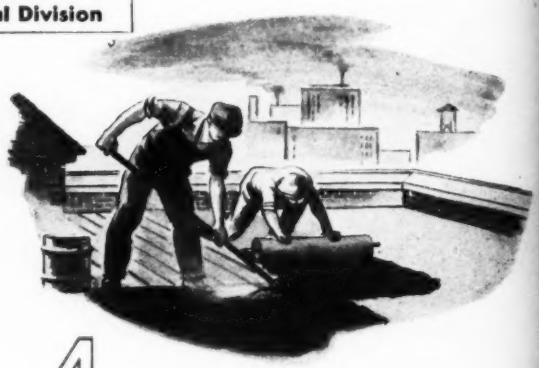
Railroads will save money with pressure-treated roof decks—Many roofs are replaced or repaired because of the failure of roof decks from decay. Yet years of experience of railroads and other big industries have shown that pressure treated wood will last year after year under severe conditions. Insist that your roof decks be built of pressure-treated wood for protection against fire and decay.

Tar and Chemical Division



3 Current

Tar that once roofed American railroad buildings now "unroofs" German buildings—Coal derivatives which used to go into coal tar roofing pitch are now one of the sources of war-vital materials for electrodes (used in electric furnaces to produce aluminum).



4 Contemplated

Wartime roofing proves anew that coal tar is best—In one wartime building alone, more than 200 railroad carloads of Koppers roofing was used. On these vast roofing projects, valuable lessons have been learned . . . and the best advice is "Stick to tar."

Koppers Company and Affiliates, Pittsburgh, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY